X-320M™

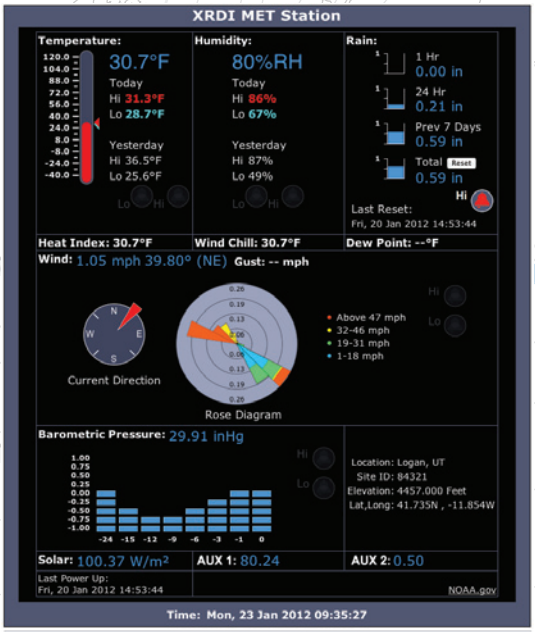
User's Manual

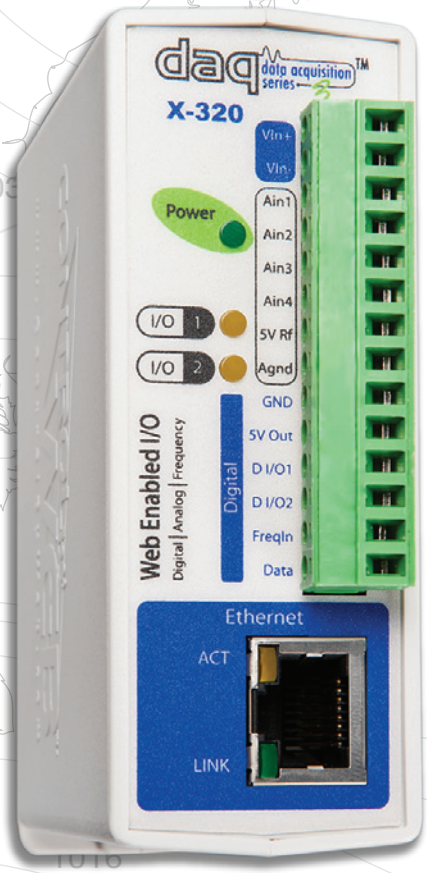
Revision 1.0

Covers Models: X-320M-I

DIREKTRONIK
Direktronik AB tel. 08-52 400 700 www.direktronik.se

daq data acquisition series 3™





CONTROL by WEB™
www.ControlByWeb.com

a division of....

Xytronix Research & Design, Inc.
North Logan, Utah, USA

Web Enabled Meteorological Station Controller

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FCC Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

Warning

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause interference to radio communications. There is no guarantee, however, that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into a relay on a circuit different from where the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Notice

Changes or modification not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.

Installation Guidelines (Read Before Installing)

- This unit must be installed by qualified personnel.
- This unit must not be installed directly outdoors.
- This unit must not be used for medical, life saving purposes, or for any purpose where its failure could cause serious injury or the loss of life.
- This unit must not be used in any way where its function or failure could cause significant loss or property damage.

Security Notes

X-320M™ does not employ a general purpose computer operating system and does not have features such as telnet, FTP, SSH, nor uncontrolled open ports. This means it is not possible for someone to 'break in' to X-320M™ and access other devices on your local network. The simplicity of X-320M™ makes it an inherently secure device. Nevertheless, as with any device installed on a network, appropriate security precautions should be observed.

If X-320M™ is installed on the Internet, it is recommended that passwords be enabled for the **Control Page**. Passwords should be at least 8 characters in length and use a combination of upper and lower case letters and numbers. For additional security, a firewall may be used to limit access to selected IP addresses. Another option may be to set up a Virtual Private Network (VPN) between the network where X-320M™ resides and the client machine (web browser, another, ControlByWeb™ product, etc.).

Final Installation Notes

This ControlByWeb™ product supports connection to *10 Mbps* and *100 Mbps* networks. Although *100 Mbps* networks are faster, the amount of data transferred to and from this device is very minimal and little, if any, performance increase will be gained by setting it to *100 Mbps*. There are advantages, however, to operate this device at *10 Mbps*. At *10 Mbps*, less power is required, the unit runs cooler, and the lifetime of the product will be extended.

Any changes to the Ethernet settings will require a removing and re-applying power to X-320M™.

Section 1: Introduction

X-320M™ contains a unique combination of dedicated meteorological instrument functions as well as general purpose control capability in a compact, cost-effective package. Like all ControlbyWeb products, X-320M™ is designed to operate through a web browser; no driver required, no subscription, no remote server, no script programming.

A variety of weather sensors can be leveraged by X-320M™ for casual or scientific purposes. A list of compatible sensors is available from Xytronix Research and Design, Inc.

For those using X-320M™ with the Davis Instruments Integrated Sensor Suite (ISS), an adapter kit is available which facilitates connections to the Davis sensors and enables the Davis temperature and humidity sensors so they can be used by X-320™.

X-320M™ comes pre-installed with a weather station interface. Once the desired instruments are connected and basic network parameters are configured, the users can immediately see a user-friendly weather station on any HTML 5 browser.

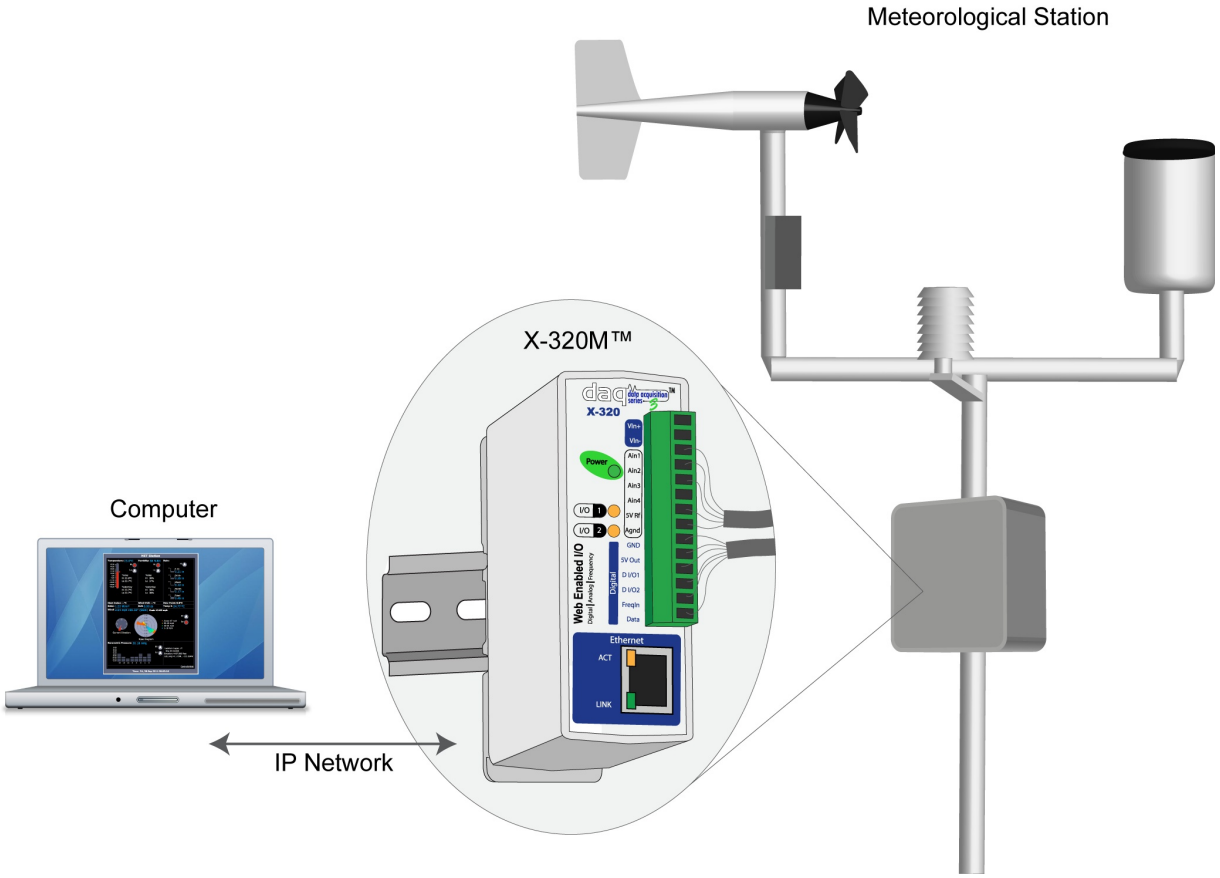


Figure 1.1a - Example Meteorological Station Setup

With proper configuration of Ethernet gateways, X-320M™ can be viewed through an Internet connection at remote locations.

In addition to standard weather information, users can leverage the sophistication of X-320M™ for some of the following functions:

- Data logging.
- Email or SMS text alerts on exception conditions, such as freezing temperature.
- Trigger alarms using remote relays on other ControlByWeb products based on weather conditions, such as high wind.
- Disable irrigation system with high wind or rain.
- Expand X-320M with remote analog input capability allowing instruments to be located elsewhere on the network.
- Password-protected interface.
- Automatic time synchronization through NTP service.
- Using the Remote Services interface, data from multiple X-320s and other ControlByWeb products can be aggregated under a common server.

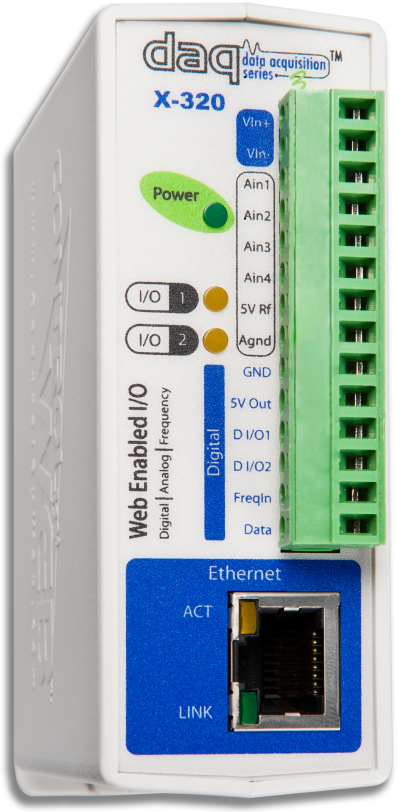


Figure 1.1b - Product Image

1.1 X-320M™ Features

Frequency Input (1)

130 kHz maximum input, 0-5 V.
Wind sensors such as the RM Young 5103 use a frequency signal that is proportional to the wind speed.

Analog Input (4)

24-bit analog measurements from 0-5 VDC.
Common analog sensors include wind vane, pyranometer, barometric pressure, humidity, and temperature.
Also configurable as “digital” inputs with programmable switching thresholds for use with such things as lightning detectors.

Digital I/O (2)

Programmable as outputs or inputs with selectable pull-up and pull-down resistors on inputs.
Pulse counter and pulse rate, 250 Hz max.
Inputs are compatible with switch-type wind speed sensors, and tipping bucket rain sensors.
Outputs can be used for irrigation and pump control.

Remote Relays (2)

Control relays on other ControlByWeb products based on input conditions. Useful for remote control of alarms, irrigation systems, or equipment protection applications, such as cutting power during lightning activity or turning on heating equipment in freezing conditions.

Remote Analog (4)

Expand sensor capability with up to 4 analog inputs from another device such as an X-320™ or Analog Module.

Temperature or Humidity Digital Sensor Inputs (6)

Monitor any combination of temperature or humidity sensors up to 600 ft away. Wall mount and sealed sensor probes are available for use with indoor and soil temperature applications.

Real-time Clock

Manual or NTP capability.

Logging

Configurable logging for attached meteorological sensors.
System logging of device operating parameters and events, such as power reset and NTP requests.

Email Notification

Send email alerts based on any sensor conditions, such as high wind, low temperature, or lightning.
Send text messages to cell phone through your wireless carriers email bridge.

Web Server and Protocols

All configurable through the built-in, password protected web server. Additional interface options include XML and SNMP. Static or DHCP IP address configuration.

1.2 X-320M™ Models Available

X-320M™ is currently available in one model.

X-320M-I	Web-enabled Meteorological Station Controller

1.2.1 Optional Accessories

Accessory	Description	Part Number
Temperature Sensor	Digital temperature sensor with 12 inch wire leads. Note: Leads may be extended.	X-DTS-U
Temperature Sensor (Wall Mount)	Digital temperature sensor housed in vented plastic enclosure.	X-DTS-WM
Temperature/Humidity Sensor (Wall Mount)	Digital temperature and humidity sensor housed in vented plastic enclosure.	X-DTHS-WM
Davis Adapter Kit	Used with the Davis Instruments ISS to connect the Davis sensors to X-320M™.	X-MDA-1

Note: For a list of compatible sensors, please contact customer support.

1.3 Connectors & Indicators

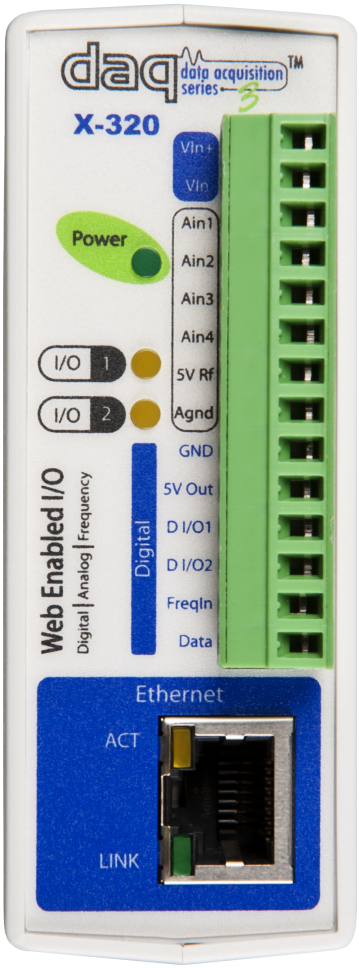


Figure 1.4a - Connections & Indicators

I/O Connector

X-320M™ has a 14-position removable terminal connector. Which is used to provide power to the module and connect Digital I/O, Analog Inputs, Frequency Input, and Temperature/Humidity Sensor Inputs.

Network Connector

The Ethernet connector is a standard 8-position modular receptacle.

Module Power Indicator

The green Power LED indicator is illuminated whenever the module is powered.

I/O Indicators

Two amber LEDs illuminate when the corresponding Input or Output is active.

Ethernet Indicators

The LINK LED is illuminated green when the module is properly connected to an Ethernet network and is ready to communicate. Network communications will only occur if this LED is illuminated. The ACT LED flashes amber when activity is detected on the network.

1.4 Accessing X-320M™

Standard Access Using a Web Browser

X-320M™ has a built-in web server that provides simple web pages that can be accessed directly using a standard web browser. This allows users to access the unit with NO SPECIAL SOFTWARE installed on their computer. This is ideal for applications that require a quick, simple solution that does not need to be accessible to more than a few people. This configuration is simple to setup, simple to use, and can be accessed from any computer.

*Note: Network routers may need to be configured to allow access from computers outside of the local network (see **Appendix C: Accessing X-320M™ Over The Internet**).*

Section 2: Installation and Setup

Installation consists of mounting X-320M™, connecting it to an Ethernet network, providing power, configuring via a web browser, and wiring the Digital I/O's, Analog Inputs, Frequency Inputs, and Temperature and/or Humidity Sensors.

2.1 Mounting

X-320M™ can be wall mounted or mounted to a standard (35mm by 7.55mm) DIN-Rail. It should be mounted in a clean, dry location where it is protected from the elements. Ventilation is recommend for installations where ambient air temperatures are expected to be high.

See **Appendix H: Mechanical Information** for additional mechanical details.

2.1.1 Wall Mounting

Mount X-320M™ to a wall using two #8 screws. Attach the screws to the wall vertically spaced exactly 2.5 inches apart. The head of the screw should be about 1/10 inch away from the wall.

2.1.2 DIN-Rail Mounting

Attach X-320M™ to the DIN-Rail by hooking the top hook on the back of the enclosure to the DIN-Rail and then snap the bottom hook into place. To remove X-320M™ from the DIN-Rail, use a flat-head screwdriver. Insert a flathead screwdriver into the notch in the release tab and pry against the enclosure to release the bottom hook.

2.2 Connection

CAUTION: MAKE SURE POWER IS SHUT OFF BEFORE WIRING!

CAUTION: THIS UNIT SHOULD BE INSTALLED BY A QUALIFIED TECHNICIAN.

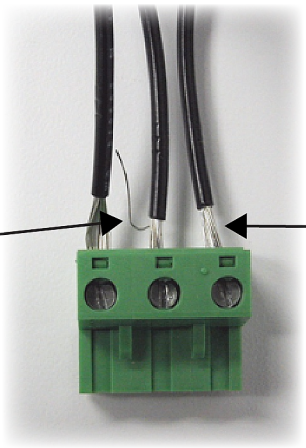
MIS-WIRING OR MIS-CONFIGURATION COULD CAUSE PERMANENT DAMAGE TO X-320M™, THE EQUIPMENT TO WHICH IT IS CONNECTED, OR BOTH.

A removable terminal connector is provided for simple wiring. The correct wiring procedure is as follows:

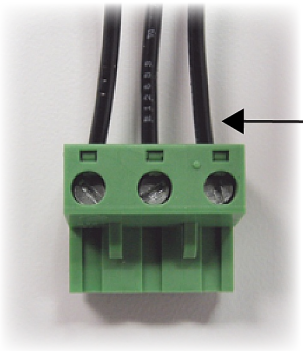
1. Make sure power is turned off.
2. Remove the terminal connector from X-320M™ and make wiring connections to the terminals.
3. Reconnect the terminal connector.
4. Apply power.

It is recommended that the load (device to be controlled) not be connected to X-320M™ until after X-320M™ has been configured and tested. By doing this, wiring and configuration mistakes will not cause the load device to turn on unexpectedly.

Bad Connector Example



Good Connector Example



IMPORTANT: MAKE SURE WIRES ARE PROPERLY ATTACHED TO THE TERMINALS AND THAT THE TERMINALS ARE TIGHT!

14-pin Connector Pinout	
Pin	**Description**
Vin+	Power Supply VDC+. 9-28 VDC for model X-320M-I. DO NOT EXCEED MAXIMUM POWER SUPPLY VOLTAGE.
Vin-	VDC- (Ground) power supply input.
Ain1	Analog Input 1 used with 0-5 V analog sensors, such as temp, solar, humidity, and barometric pressure.
Ain2	Analog Input 2.
Ain3	Analog Input 3.
Ain4	Analog Input 4.
5V Rf	+5 VDC reference output for analog sensors.
AGnd	Analog Ground for Analog inputs.
Gnd	Digital Ground for 5V Out return used with Outputs, Inputs, Frequency inputs, and digital Temperature/ Humidity sensors.
5V Out	+5 VDC Output. Voltage output for digital inputs and for the digital temperature and humidity sensors.
D I/O 1	Digital I/O 1 can be configured as logic input, output, rate, or counter. Programmable pull-up resistor for input mode.
D I/O 2	Digital I/O 2, same as above.
FreqIn	AC frequency counter.
Data	Temperature/Humidity Data Input for “1-wire” digital temperature and humidity sensors.

2.2.1 Power Supply Connection

X-320M™ requires power for its internal logic circuits. Connect a 9-28 VDC power supply to the Vin+ and Vin- terminals. Note that a regulated power supply is recommended, such as a wall-mount AC-DC adapter, or POE Injector and Splitter. Verify that the adapter is rated for the operating current of X-320M™ (See **Appendix G: Specifications** for current requirements.)

Note: Vin- should be tied to Earth ground.

Multiple X-320M™ units may be connected to a single power supply by connecting the power supply input terminals in parallel. The power supply must have a high enough current rating to power all units connected. (See **Appendix G: Specification**s for current requirements.)

2.2.2 Digital Input/Output Connections

The Digital I/O's can be individually programmed to function as either inputs or outputs. When configured as inputs, pull-up or pull-down resistors can be programmed. For unconnected inputs, the pull resistors will be read as ON when pulled up, or OFF when pulled down.

Input Connection

The inputs can be configured to count the tips of the bucket in a rain collector, the rate of spin on a wind speed sensor, or detect switch closures on other connected devices, such as a lightning detector.

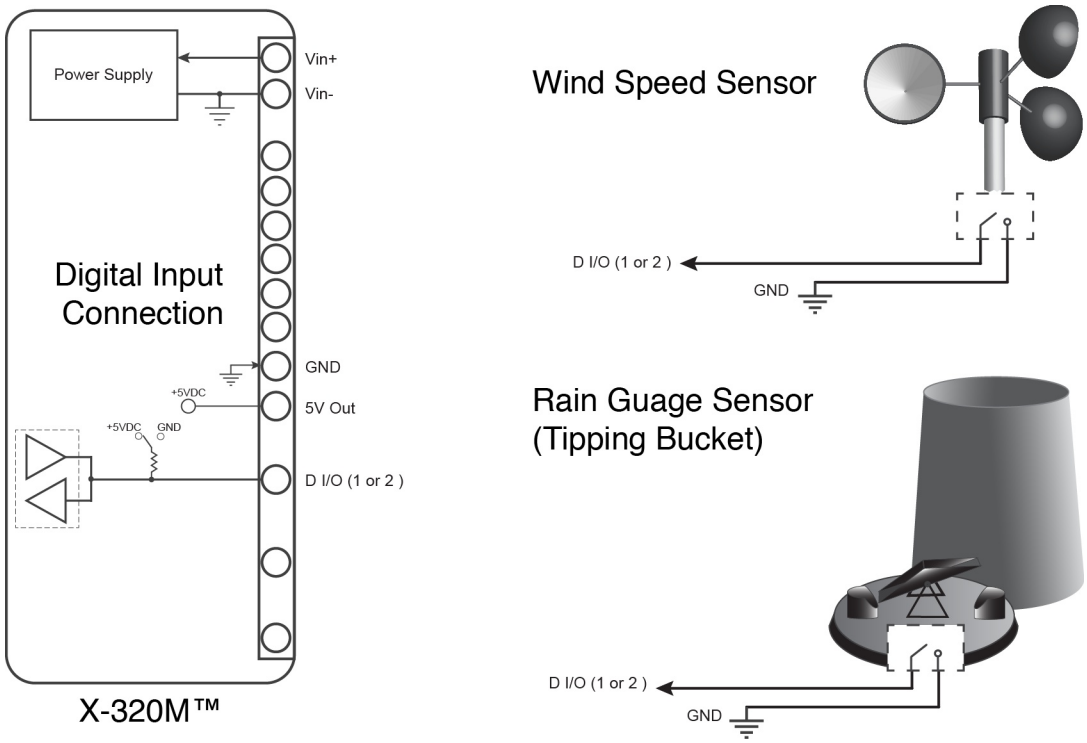


Figure 2.2a - Digital Input Connections

Pull-Up/Pull-Down Resistors

Weak pull resistors are used to control the state of the inputs when they are unconnected, such as when connected to an open switch. Devices that use a switch contact, such as rain buckets, require the input to be configured with a pull-up resistor. One side of the contact is connected to I/O 1 or I/O 2, and the other side is connected to Gnd. When the bucket in a rain collector tips, the contact is momentarily closed, causing the input to pulse **OFF.** This pulse increments the rain bucket counter.

Pull-down resistors are similar, but this configuration is typically not applicable for common weather sensors.

Output Connection

The digital outputs can be used for controlling external devices. The digital outputs have limited drive capability, but can be used with solid state relays to control larger loads.

Relays on other ControlByWeb devices can be controlled with X-320M through the Remote Relay feature. Up to two remote relays can be configured, each of which may be on a separate device.

Applications for the digital outputs and remote relays include:

Activate external audible alarm or lights in cases of high wind, temperature, lightning detection, or other sensor levels.

Deactivate pumps or irrigation system during high wind, rain, or freezing temperatures.

Disconnect sensitive equipment when lightning is detected.

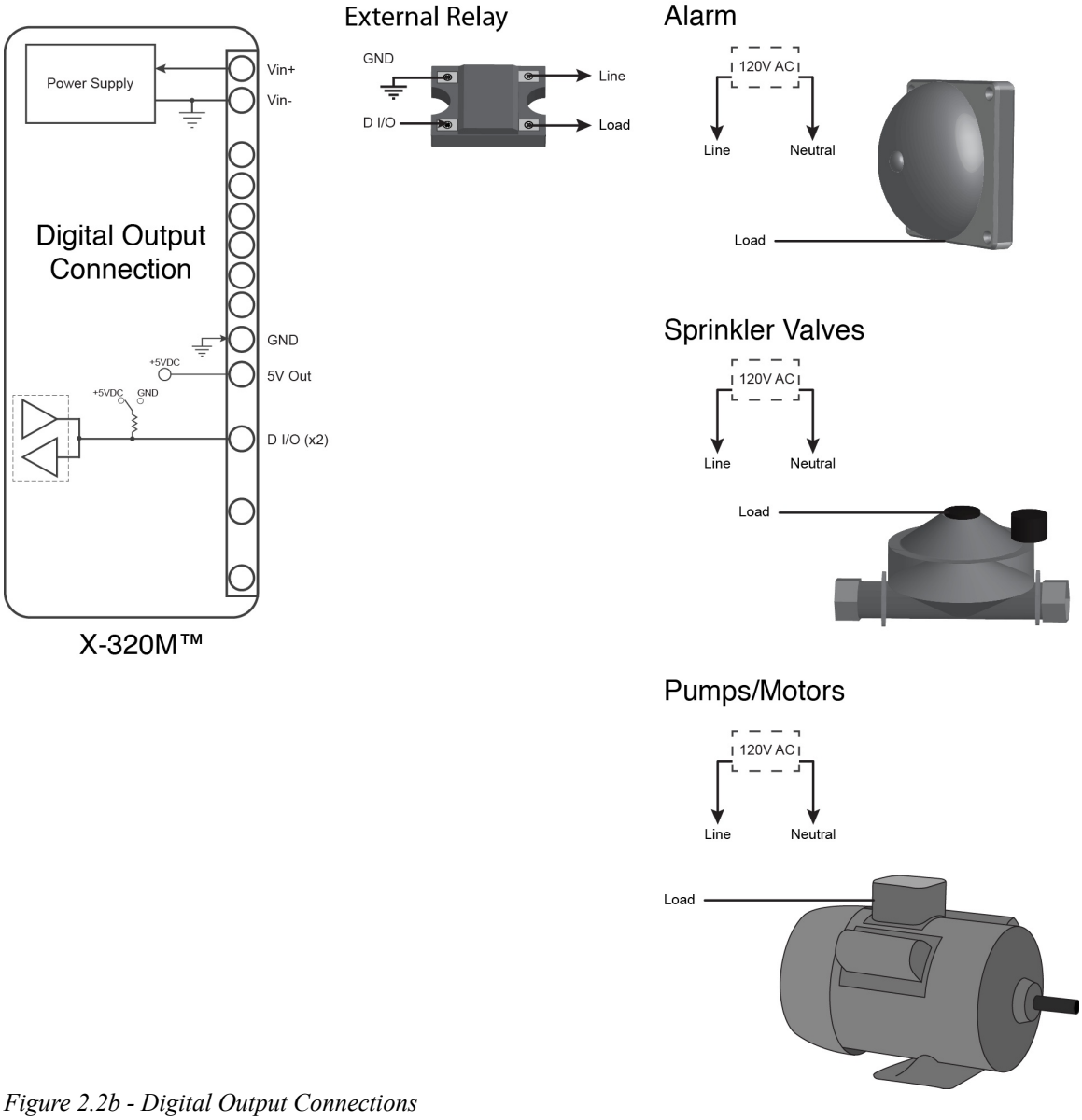


Figure 2.2b - Digital Output Connections

2.2.3 Analog Input

Voltage and current output sensors can be connected to X-320M analog inputs. Typical weather station analog sensors can measure temperature, humidity, solar radiation, barometric pressure, and soil moisture.

Additionally, the analog inputs can function in a digital mode, activating alarms based on voltage thresholds. Many stations may use both digital inputs for wind or rain sensors. An analog input may be available for such things as water (flood) or lightning detection.

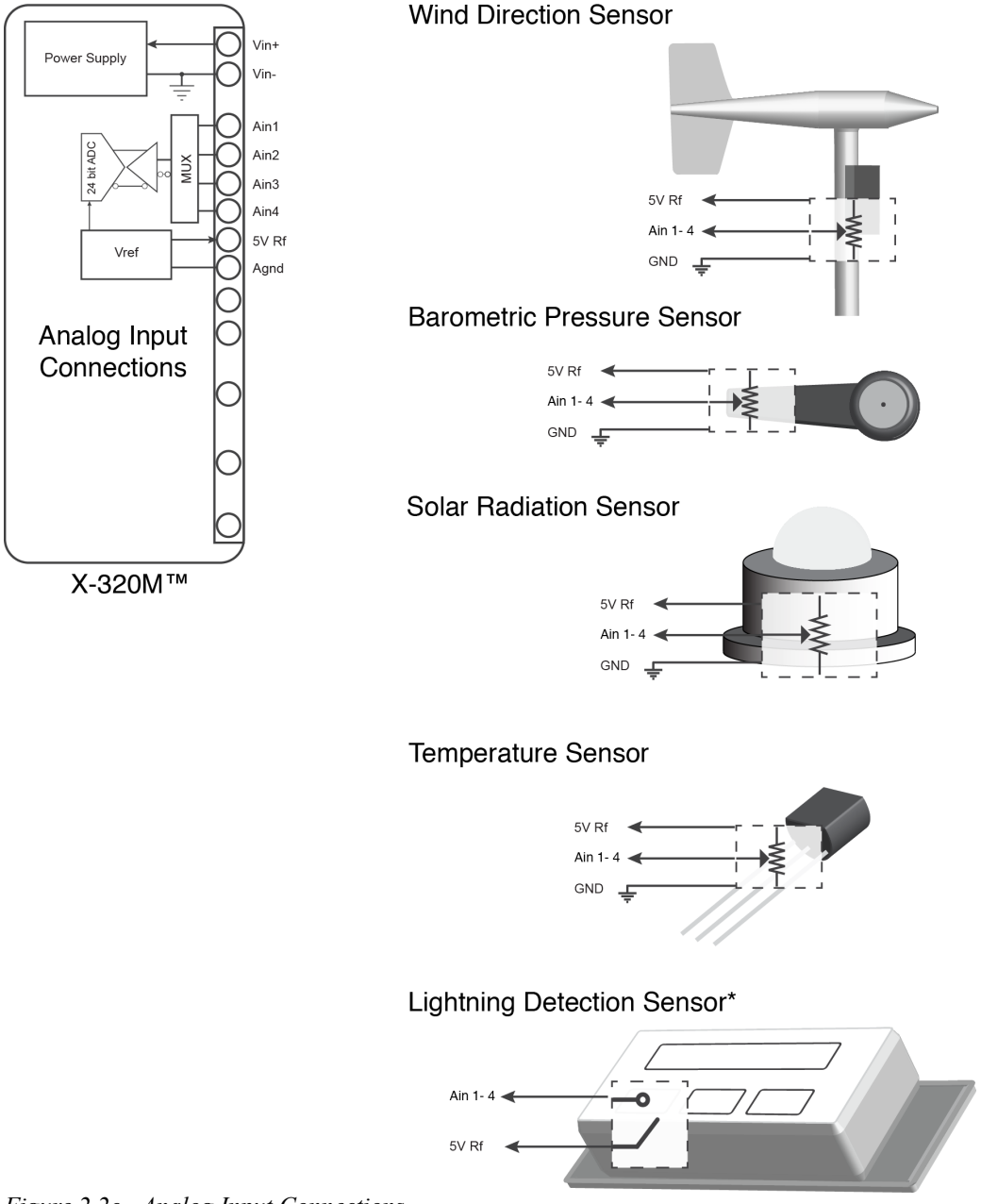


Figure 2.2c - Analog Input Connections

*Switch state signals can be used with analog inputs to trigger actions using voltage level alarms.

Wiring Considerations

The analog inputs on X-320M™ are very sensitive (10 uV) and can be affected by low level noise. The Vin- on X-320M™ should be connected to earth ground. Additionally, all cable shields should be connected to earth ground. Users should observe single-point ground strategies, typical of instrumentation systems.

Proper grounding may be accomplished by connecting the grounding cables to either the AC mains ground or to the station ground.

High Output Sensors, > 5 VDC

In the case of a sensor whose output levels are higher than 5 volts, a simple voltage divider can be used to scale down the output. The following diagram shows a simple voltage divider circuit. In the example, Vin can range from 0 to 10 volts and resistor values for R1 and R2 will be chosen so that Vout will have a range that falls within the 0 to 5 volt range of the Analog Input.

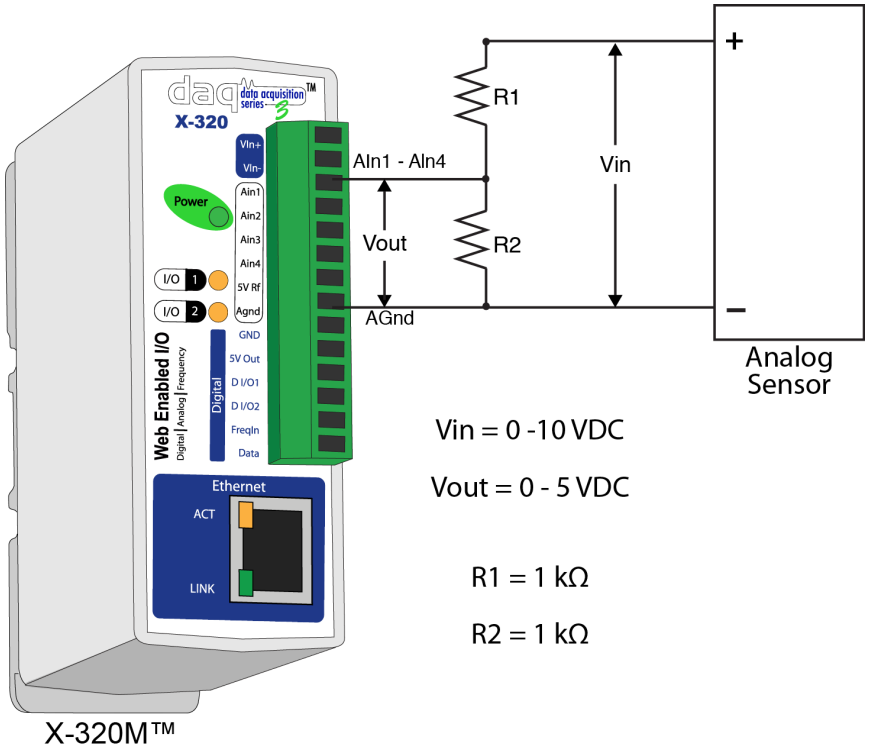


Figure 2.2d - Voltage Divider Circuit

Generally, you can choose a 1 kΩ resistor for R2 and then calculate the value of R1 using the following formula.

$$Vout = Vin * \left(\frac{R2}{(R1 + R2)} \right)$$

To determine the proper resistor value to use in the example above, use the maximum output of the sensor (10 VDC) as Vin in the equation, the maximum input value of the the Analog Inputs (5 VDC) as Vout, and R2 = 1 kΩ. Solving for R1 gives 1 kΩ.

R1 = 1 kΩ

R2 = 1 kΩ

As another example, if the maximum output voltage of the sensors is 15 VDC, choose R2 = 1 kΩ and by solving the equation, R1 = 2 kΩ.

4-20 mA Sensors (Current level conveys information, not voltage levels)

Some sensors are designed to change the output of the current instead of the voltage levels. To use these sensors, a resistor is placed in parallel with the sensors. Placing a resistor across the terminals of the sensor creates a voltage drop between them that changes as the current changes. This voltage drop can be measured by the Analog Module. The following diagram shows how to connect one of these sensors to the Analog Inputs.

For sensors that have an output of 4-20 mA, a resistor value of 250 Ω can be used to get the desired output voltage between 0 and 5 volts. Ensure that the size of the resistor is appropriate to handle the power dissipation. A 20 mA sensor at 5 V will dissipate ¼ W.

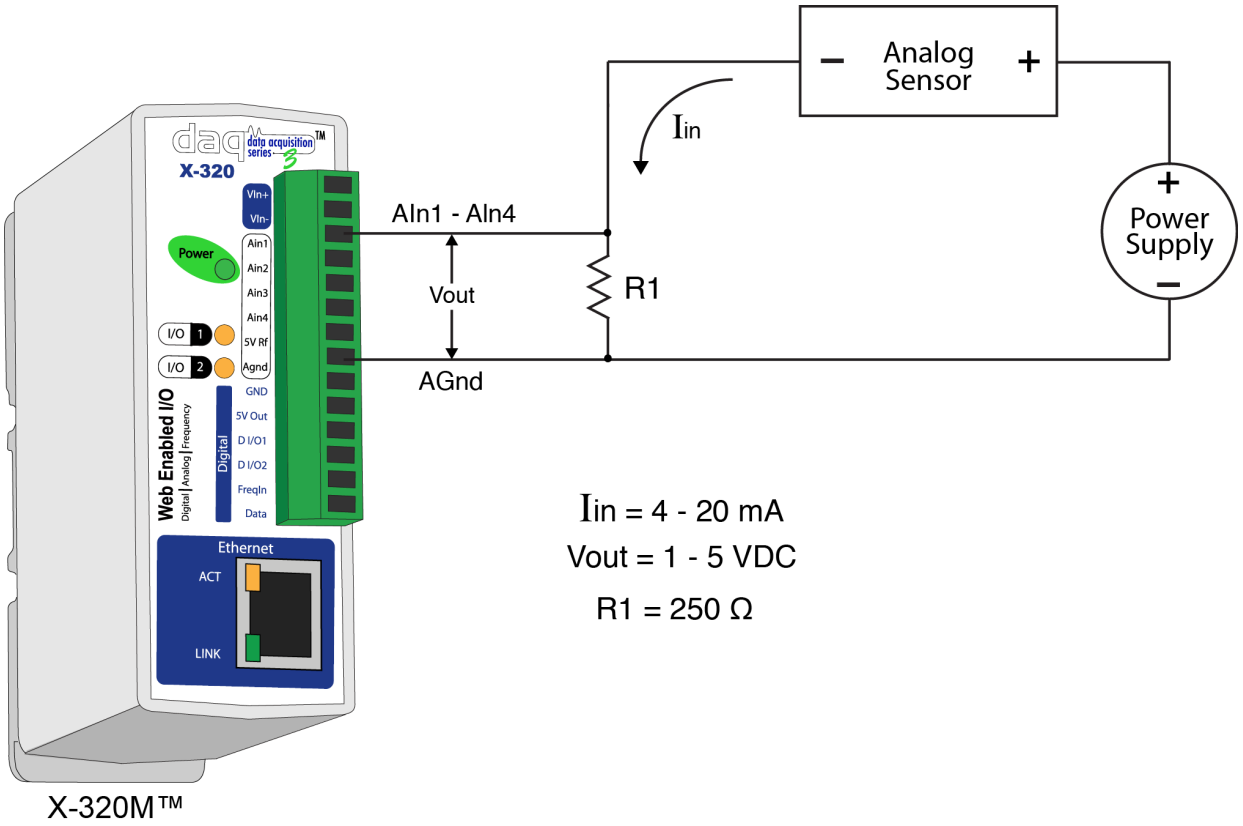
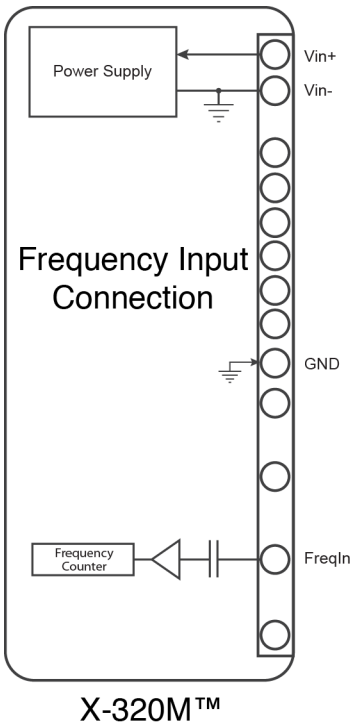


Figure 2.2e - Using a sensor with a 4-20 mA output

2.2.4 Frequency Input

Sensors that output a frequency can be connected to the Frequency Input. Connect one end of the sensor to FreqIn and the other to GND. Figure 2.2.g illustrates a wind speed sensor being connected to an X-320M™.



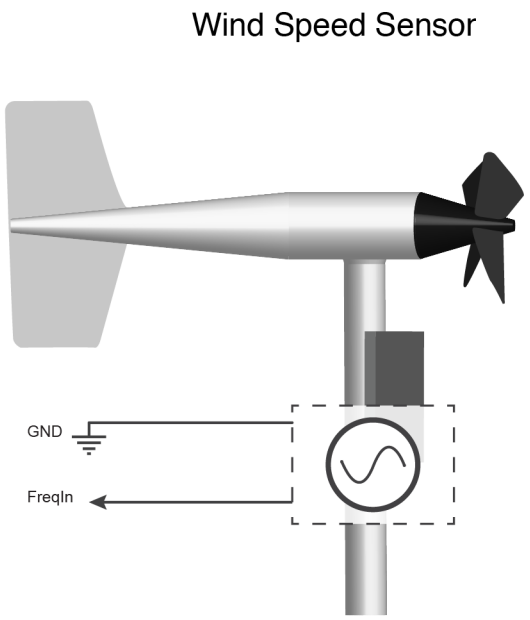


Figure 2.2f - Frequency Input Connection

Wiring Considerations

The frequency input on X-320M™ is very sensitive and can be affected by low level noise. The Vin- on X-320M™ should be connected to earth ground. Additionally, all cable shields should be connected to earth ground. Users should observe single point ground strategies, typical of instrumentation systems.

Proper grounding can be accomplished by connecting the grounding cables to either the AC mains ground or to the station ground.

2.2.5 Digital Temperature/Humidity Sensor Connection

The digital sensors use a one-wire data bus, which allows up to six sensors to share the same terminals (+5V, Ground, Data). Every sensor on the one-wire bus is assigned a unique serial number when it is manufactured. That number is used to address the device during communication.

Note: The adapter board for the Davis Instruments ISS (X-MDA-1) is an exception to the typical sensor addressing. When the X-MDA-1 is used with an ISS, the temperature and humidity sensors use the same address.

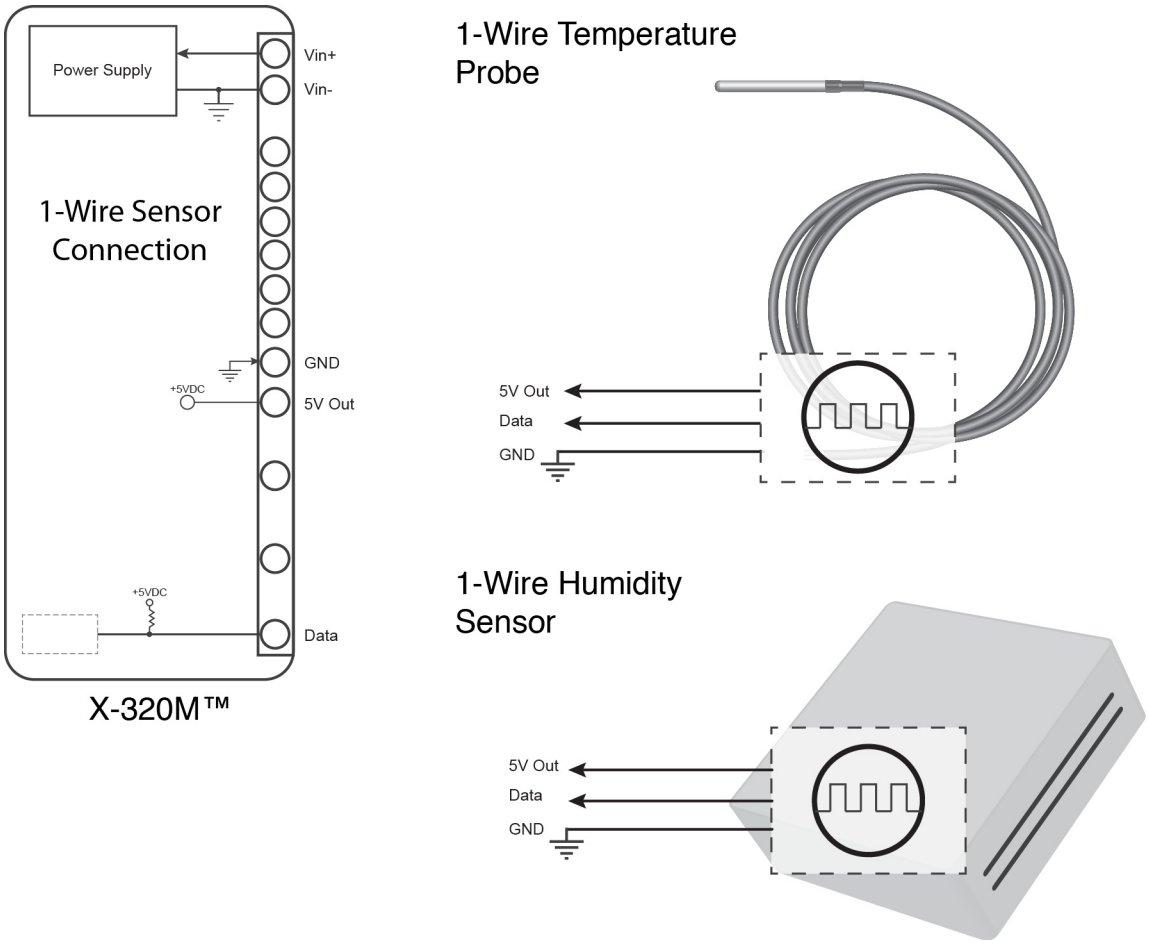


Figure 2.2g - 1-Wire Sensor Connection

The sensors have three wires; the wire color is show in the table below.

Figure 2.2h - Temperature Sensor

Sensor Wire Color	Connection
Red	5V out
Black	Gnd
Blue (or White)	Data

Multiple sensors can be connected in two ways: directly connected to the unit (star topology) or “daisy chained” (linear topology) as shown in Figure 2.2i. Many factors will determine the maximum length of cable used to connect sensors to X-320M™. Some of these factors include, but are not limited to, the type of cable used, the number of sensors, ambient electromagnetic noise, and sensor network topology. Using Cat 5e cable, combined cable lengths of 600 ft to all sensors have been successful. However, due to the uniqueness of installation environments, results may vary. Please test in the desired environment before permanent installation.

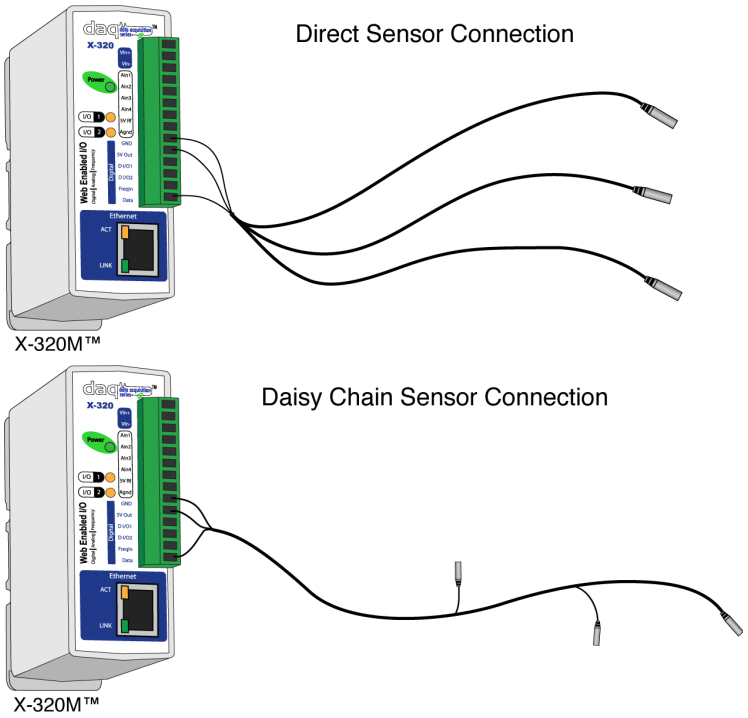


Figure 2.2i - Direct Connection (Star) and Daisy Chain Connection (Linear)

The following are general recommendations that will maximize sensor runs and minimize problems.

Cat 5 and Cat 5e network cables have proven to be an effective and low-cost solution for long runs. Other cable types can be used, but cable capacitance may limit the length. Figure 2.2j shows the recommended connection using Cat 5 network cable.

Note: It is recommended to run the Data and the Gnd on the same twisted pair, while the power be run on a single wire.

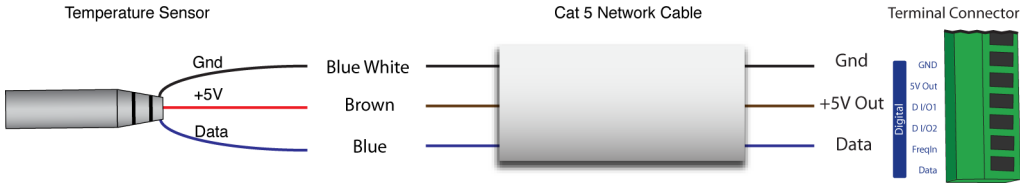


Figure 2.2j - Recommended connection using Cat 5 cable

A linear topology (daisy chain) will minimize signal reflections, providing a more reliable connection and longer cable length than a star topology.

Appropriate strain relief should be used at X-320M™ and other connections that may be subjected to vibration, movement, or repeated handling.

Avoid sensor runs adjacent to industrial equipment power cables. These cables can have high current spikes that may induce noise on the sensor signals. Similarly, avoid running sensor cables near any radio transmission antennas or coaxial feed-lines.

Protect any electrical connections with appropriate weather shielding.

Due to the broad range of applications and environments where X-320M™ may be employed, installation success on long sensor runs may vary significantly.

2.2.6 Network Connection

Connect the Ethernet port to a 10 Base-T or 10/100 Base-T Ethernet connection. This typically connects to an Ethernet hub, switch, or router. For configuration, X-320M™ may be connected directly to the Ethernet port on a computer using a “crossover” cable. Otherwise, for connection through a hub or router, a standard “straight-through” cable should be used.

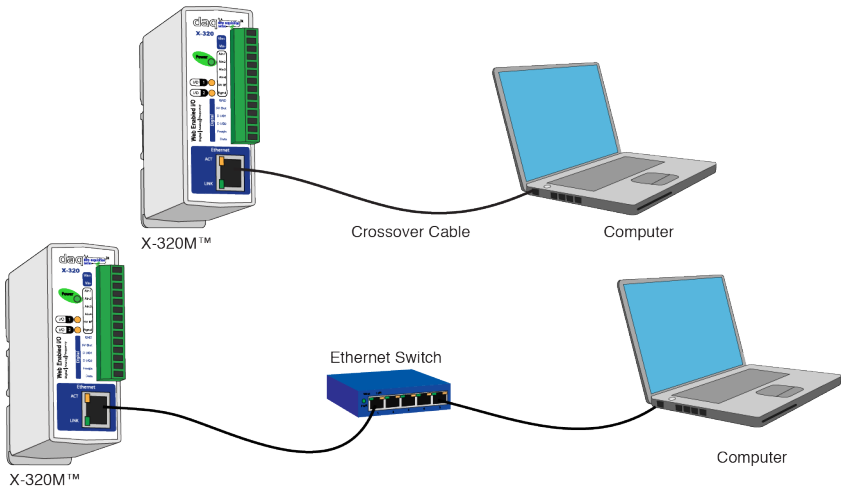


Figure 2.2k - Network Connection

X-320M™ can be used on a wireless network by connecting through an Ethernet bridge or a wireless router.

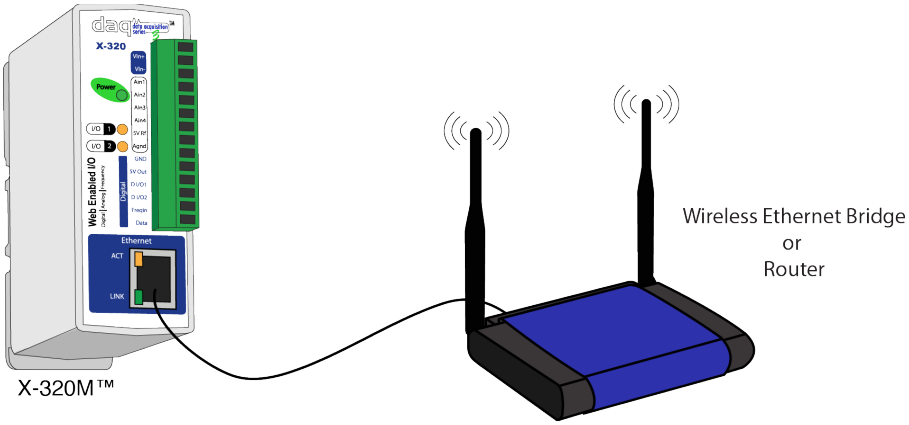


Figure 2.2l - Wireless Connection

Note: The wireless Ethernet bridge or router must be properly configured for the wireless network. Refer to the installation instructions for the wireless device.

2.3 Establishing Communications for Setup

In order to configure X-320M™ with the web browser interface, X-320M™ must be connected to an Ethernet computer network. This can be done by one of two methods:

Method 1 – Assign a temporary IP address to X-320M™ to work on an existing network.

-or-

Method 2 – Temporarily change the IP address of a connected computer to the match the default IP address used by X-320M™.

Note: If multiple ControlByWeb™ products are used on the same network, install one at a time and set the IP address of each unit before connecting the next unit to the network. This avoids having multiple devices being installed on the network with the same factory default IP address at the same time. If this approach is used, be sure to clear the arp cache after disconnecting each unit (`arp -d`).

2.3.1 Method 1: Assign a Temporary IP address to X-320M™

This option is used to TEMPORARILY assign an IP address to X-320M™ without the need to change the IP address of the configuration computer. X-320M™ will use this IP address as long as power is maintained. Once power is lost, X-320M™ will use the IP address assigned in the setup page and not the temporary address assigned here.

Make sure that X-320M™ and the configuration computer are connected to the same network.

This will not work through routers or gateways.

Microsoft Windows Instructions

1. Open a Command Prompt (select START, then RUN, then type “cmd”).

   Note: For Vista/7, the Command Prompt should be run as administrator (select Start, then type “cmd” and right click on “cmd” and select “Run as administrator”).

2. Type:

   ```
   arp -s {new IP address} {serial number of X-320M™ }
   ```

   Note: IP address format is xxx.xxx.xxx.xxx. The serial number can be found on a label on the module board. The format is ss-ss-ss-ss-ss-ss.

   For example, to set X-320M™ (with serial number 00-0C-C8-01-00-01) to 10.10.10.40 the following command would be used:

   ```
   arp -s 10.10.10.40 00-0c-c8-01-00-01
   ```

3. Next, type:

   ```
   ping -l 102 {new IP address}
   ```

   For example, if the new IP address is 10.10.10.40, the following command would be used:

   ```
   ping -l 102 10.10.10.40
   ```

4. Proceed with X-320M™ setup in section 2.4.

   Once setup is complete, it may be necessary to clear the 'arp' cache to configure additional WebRelays. This is necessary because each unit has the same default IP address, but a different unit serial number (MAC address). Clearing the arp table can be done by typing `arp -d` in the command prompt window.

Linux/Unix Instructions

1. Open a terminal and change to root user (su -, then enter root password).
2. Type:

   ```
   arp -s {new IP address} {serial number of X-320M™ }
   ```

   Note: IP address format is xxx.xxx.xxx.xxx. The serial number can be found on a label on the module board. The format is ss:ss:ss:ss:ss:ss.

   For example, to set X-320M™ (with serial number 00-0C-C8-01-00-01) to 10.10.10.40 the following command would be used:

   ```
   arp -s 10.10.10.40 00:0c:c8:01:00:01
   ```

3. Next, type:

   ```
   ping -s 102 {new IP address}
   ```

   For example, if the new IP address is 10.10.10.40, the following command would be used:

   ```
   ping -s 102 10.10.10.40
   ```

4. Proceed with X-320M™ setup in section 2.4.

   Once setup is complete, it may be necessary to clear the 'arp' cache to configure additional WebRelays. This is necessary because each unit has the same default IP address, but a different unit serial number (MAC address). Clearing the arp table can be done by typing `sudo arp -d -a` in the terminal window.

Mac OS X Instructions

1. Open a terminal.

   Note: The terminal is in the "Utilities" directory, which is in the "Applications" directory.

2. Type:

   ```
   sudo arp -s {new IP address} {serial number of X-320M™ }
   ```

   Administrator password may be required.

   Note: IP address format is xxx.xxx.xxx.xxx. The serial number can be found on the label on the module board. The format is ss:ss:ss:ss:ss:ss.

   For example, to set a X-320M™ (with serial number 00-0C-C8-01-00-01) to 10.10.10.40 the following command would be used:

   ```
   sudo arp -s 10.10.10.40 00:0c:c8:01:00:01
   ```

3. Next, type:

   ```
   ping -s 102 {new IP address}
   ```

   For example, if the new IP address is 10.10.10.40, the following command would be used:

   ```
   ping -s 102 10.10.10.40
   ```

4. Proceed with X-320M™ setup in section 2.4.

   Once setup is complete, it may be necessary to clear the 'arp' cache to configure additional WebRelays. This is necessary because each unit has the same default IP address, but a different unit serial number (MAC address). Clearing the arp table can be done by typing `sudo arp -d -a` in the terminal window.

2.3.2 Method 2: Assign a Temporary IP Address to Configuration Computer

If the foregoing option above is not used, you can use this option to communicate with X-320M™. By default, X-320M™ comes from the factory with an IP address of 192.168.1.2. Communications with X-320M™ may be established by assigning an IP address to the configuration computer that is on the same network as X-320M™ (for example, the configuration computer could be assigned to 192.168.1.50)

The following example is for those running the Windows operating system:

1. Windows XP – Open the control panel by clicking on the start menu and then on Control Panel.

   Windows Vista/7 – Select the Windows Icon (Start Menu) and enter `ncpa.cpl` into the search bar and press Enter (Figure 2.3a).

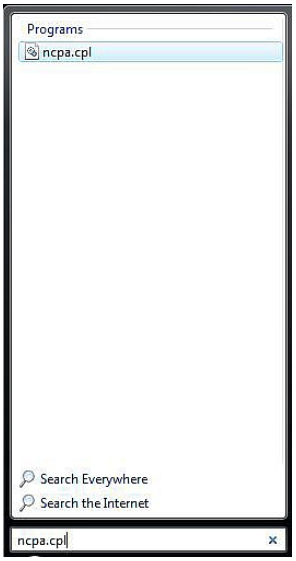


Figure 2.3a- Vista/7 Start Menu

Note: The control panel shown (Figure 2.3b) is in "Classic View." If the control panel is in "Category View," select the "Classic View" option before proceeding.

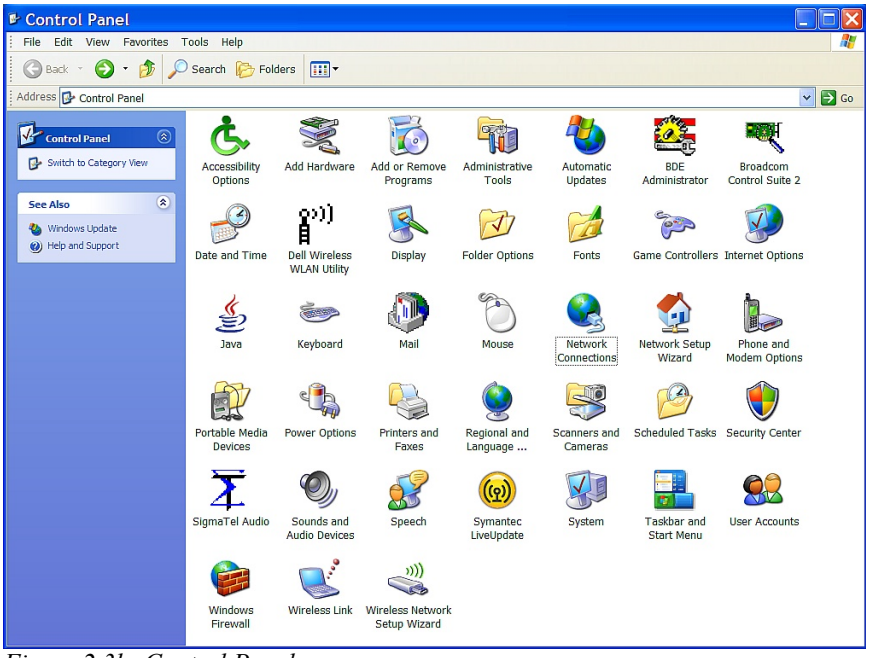


Figure 2.3b- Control Panel

2. Double click on the icon labeled Network Connections. The Network Connections window will open (Figure 2.3c).

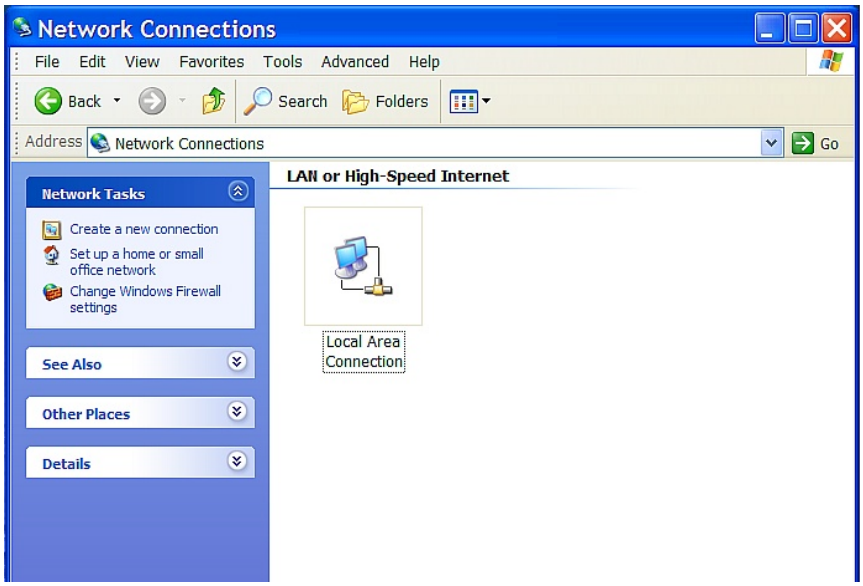


Figure 2.3c- Network Connection

3. Right click on the icon labeled Local Area Connection. In the menu that follows, select the option at the bottom of the menu labeled Properties. The Local Area Connection Properties window will appear (Figure 2.3d).

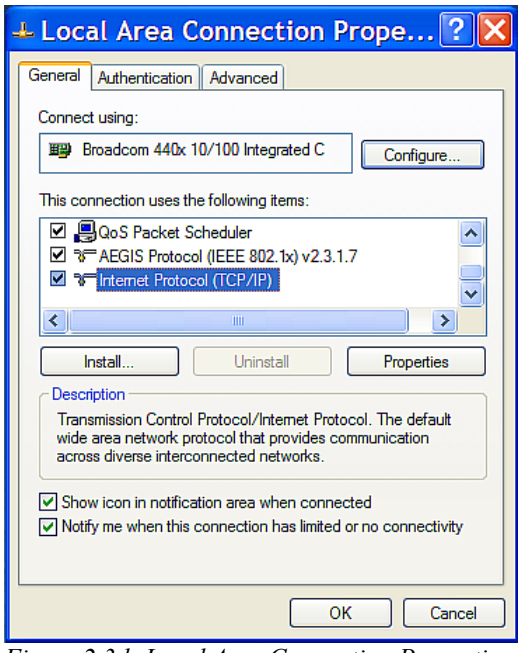


Figure 2.3d- Local Area Connection Properties

4. In the Local Area Connection Properties window in the Connection Uses box, scroll down and highlight “Internet Protocol (TCP/IPv4).” Click the button labeled Properties. The Internet Protocol (TCP/IPv4) Properties menu appears (Figure 2.3e).

   Note: If “Use the following IP address” is already selected, the computer has been set up with a static IP address. Record these values so that the IP address of the computer can be restored once the IP address of X-320M™ has been successfully changed.

5. Select the radio button labeled "Use the following IP address" and type in the IP address:

   `192.168.1.50`

6. Type in the subnet mask:

   `255.255.255.0`

   No need to change the default gateway field. Click OK to accept the new settings.

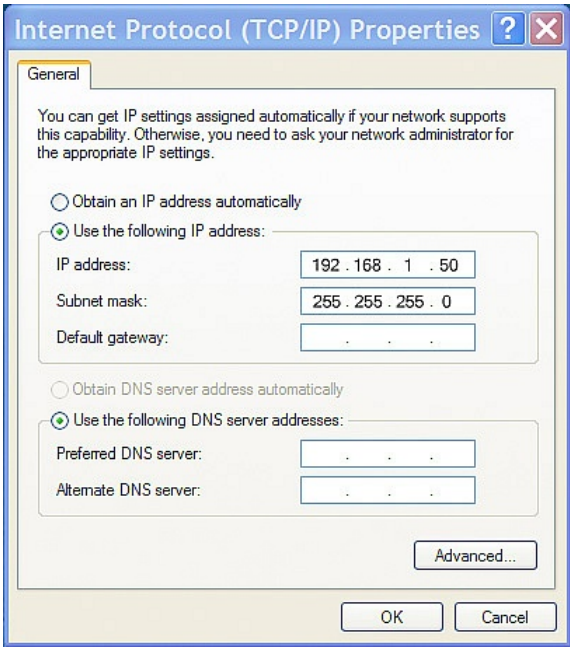

Internet Protocol (TCP/IP) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
192 . 168 . 1 . 50
Subnet mask:
255 . 255 . 255 . 0
Default gateway:
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel

Figure 2.3e- TCP/IP Properties

7. Open the setup pages as described in section 2.4. If the setup pages are not accessible, verify that X-320M™ is powered on and that the LINK light is illuminated. Check all network connections and settings.

   Another way to check communications is to ping X-320M™ from the command prompt by typing ping `X-320M IP address`.

2.4 X-320M™ Setup Pages

X-320M™ is configured using a web browser. To access the setup pages, enter the following URL in the address bar of a web browser:

```
http://{ipaddress}/setup.html
```

For example, using the default IP address, enter:

```
http://192.168.1.2/setup.html
```

After the page is requested, a password prompt will appear. Enter the username and password. The default username is `admin` and the default password is `webrelay` (password is case sensitive).

2.4.1 Main Tab

This is the initial page that is displayed when setup.html is entered into the address bar of the browser. It displays model and serial number information.

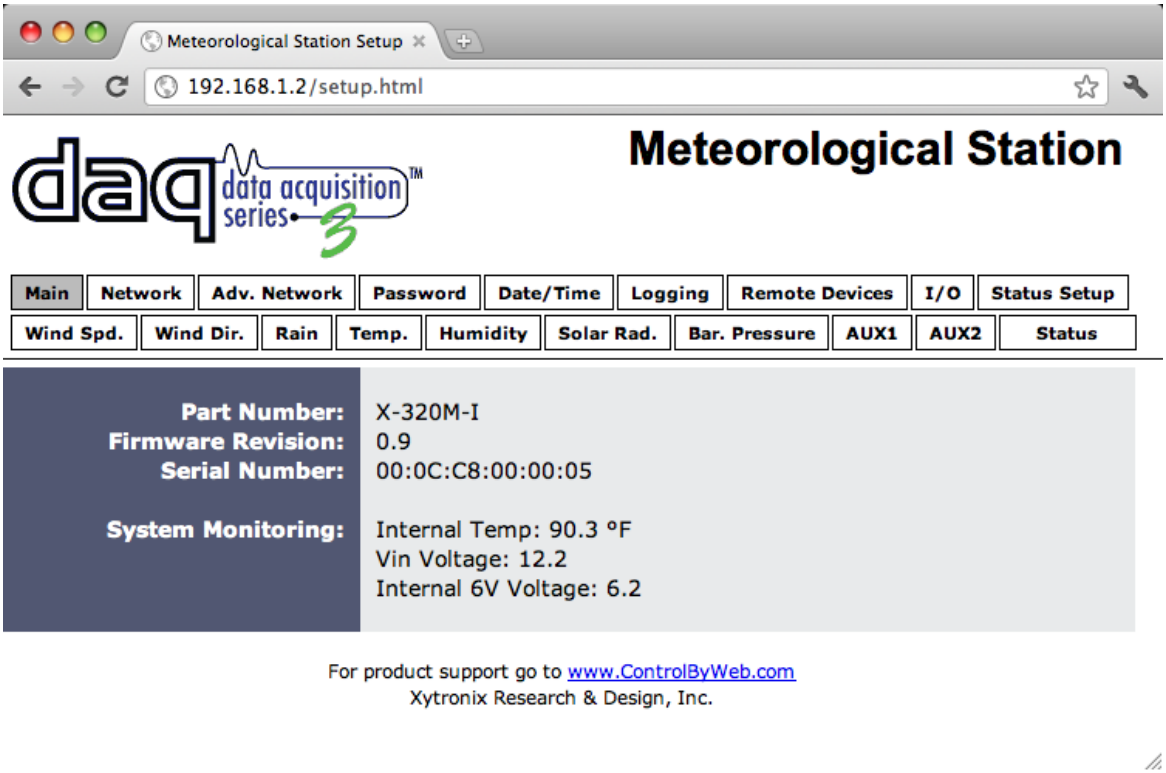


Figure 2.4a - Main Setup Tab

Part Number

This is the full model number of X-320M™.

Firmware Revision

This is the current product revision of the unit's firmware.

Serial Number

This is the serial number of this unit. The serial number is also the MAC address of the unit.

System Monitoring:

Internal Temp: This displays the current temperature inside X-320M™. Note that it is normal for this to be significantly higher than room temperature.

Vin Voltage: This is the DC voltage that is applied to the Vin+ and Vin- terminals.

Internal 6V Voltage: Internally, the unit operates on a 6 VDC power supply. This field is used to view the current value.

Note: The values in these fields are only updated when the webpage is refreshed.

2.4.2 Network Tab

The network parameters are set on this page.

*Note: X-320M™ must be power-cycled (power disconnected, then reconnected) before network settings take effect. Only the settings on the **Network** tab require power-cycling before taking effect.*

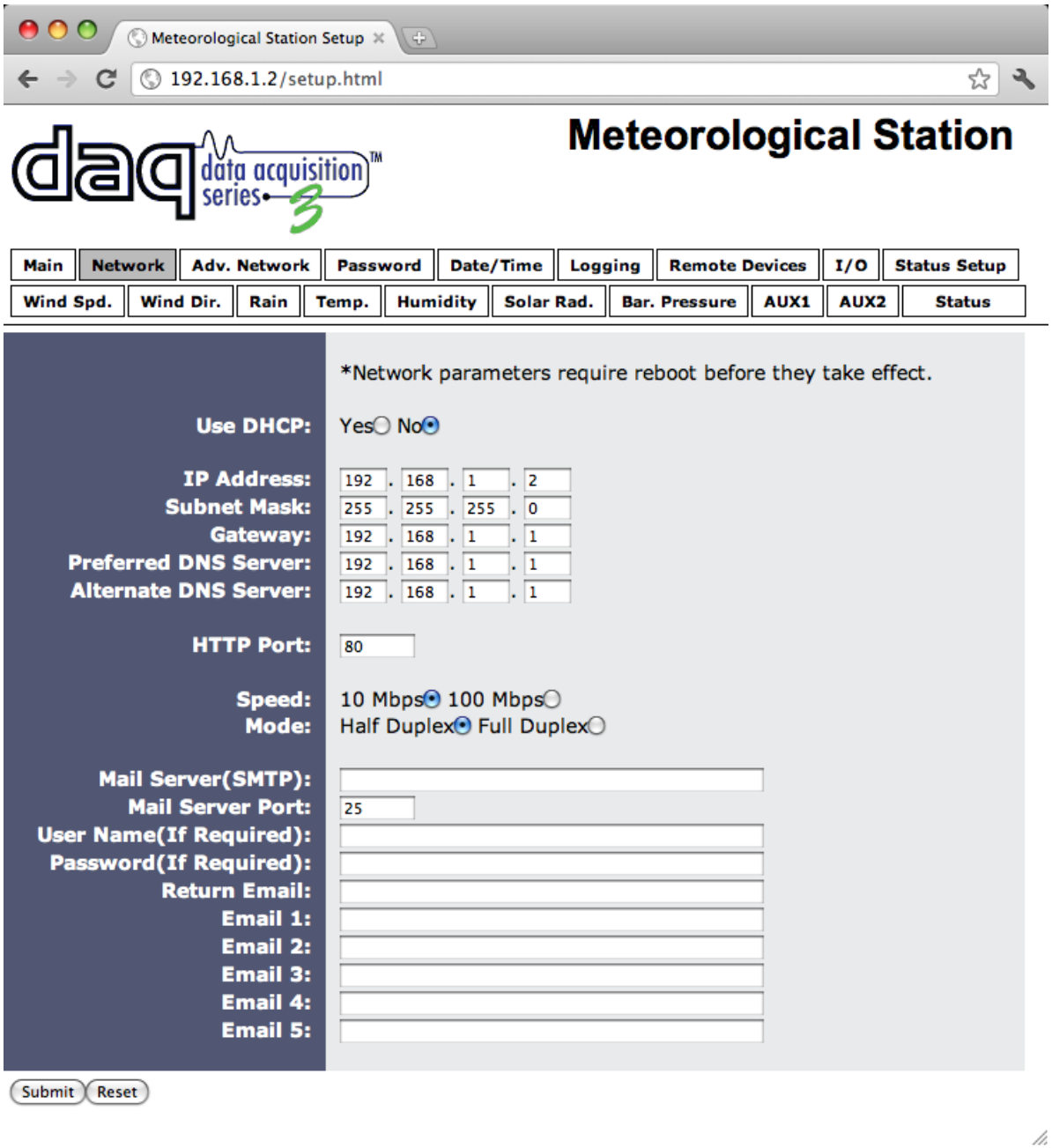


Figure 2.4b - Network Tab

Use DHCP

This option allows DHCP to be enabled or disabled. If this option is set to ***Yes***, X-320M™ will wait for an IP address from a DHCP server each time it is powered. If DHCP is set to ***Yes***, the Network page must be submitted and X-320M™ must be rebooted before an IP address will be assigned. Once X-320M™ is assigned an IP address by the DHCP, the new IP address can be found through the list of clients kept by the DHCP server. For most instances, this is found on the local gateway or router. (See **Brief Notes About DHCP** at the end of this section for more information.) The default setting is ***No*** (this is recommended for most installations).

IP Address

Enter the IP address for X-320M™ in this field. The IP address is specific to the network where X-320M™ will be installed, and must be obtained from the network administrator. For more information on IP addresses and remotely accessing X-320M™ over the Internet, see **Appendix C: Accessing X-320M™ Remotely Over the Internet**. The default setting for this field is 192.168.1.2.

Subnet Mask

The subnet mask defines the size of the local network. This can be obtained from the network administrator. For additional information about sub-netting and IP networking, many tutorials are available on the Internet. The default setting for this field is 255.255.255.0.

Gateway

This specifies the IP address of the gateway router. This can be obtained from the network administrator. The default setting for this field is 192.168.1.1.

Preferred DNS Server

The IP address of the Primary DNS server is specified here. When DNS services are required, this is the address that will be used. The default setting for this field is 192.168.1.1.

This field is only required when the following options are used:

- **Remote Services** (when server is specified by name and not IP address).
- **Sync time clock with remote NTP server** (when server is specified by name and not IP address).
- **Mail Server** (when server is specified by name and not IP address).

Alternate DNS Server

This field is used to specify the IP address of a Secondary DNS server. This is used when X-320M™ requires DNS services and the preferred DNS server is not available. The default setting for this field is 192.168.1.1.

HTTP Port

The TCP port used for HTTP communications (web browser, xml, get commands) with X-320M™ is specified here. The default setting for this field is 80, which is the standard HTTP port. It is recommended that the port be left unchanged, unless the user has an understanding of TCP/IP and ports. For more information on TCP ports and IP addressing see **Appendix C: Accessing X-320M™ Remotely Over the Internet**.

Speed

This option sets the data rate (clock rate) of the Ethernet port. Either ***10 Mbps*** or ***100 Mbps*** can be selected. The ***100 Mbps*** option offers faster communications, but the amount of data to and from X-320M™ is so small that users will not likely notice much (if any) difference. When X-320M™ is set to

10 Mbps, it draws less power and runs a little cooler, which may translate into a longer product life. The default setting for this field is ***10 Mbps***.

IT IS RECOMMENDED THAT THIS SETTING BE LEFT AT **10 Mbps** UNLESS THE USER HAS A SPECIFIC REASON TO USE **100 Mbps.**

Mode

This option allows the Ethernet port to be set to ***Half Duplex*** or ***Full Duplex***. Legacy Ethernet operates in ***Half Duplex*** mode, which means that devices can either send data or receive data, but not both at the same time. ***Full Duplex*** means that devices can send and receive data at the same time. The default setting for this field is ***Half Duplex***.

Mail Server (SMTP)

The name of the SMTP (Simple Mail Transfer Protocol) mail server (for example mail.example.com) or the IP address of the mail server (for example 192.10.10.10) should be entered in this field. There is no default setting for this field.

Note: If the server name is entered and not the IP address, the address of a DNS server will be required.

Mail Server Port

This field is used to specify the SMTP Mail Server Port. The default setting is 25, which is the standard SMTP port.

User Name (If Required)

If the SMTP mail server requires authentication, the user name must be entered here. There is no default setting for this field.

Password (If Required)

If the SMTP mail server requires authentication, the password must be entered here. There is no default setting for this field.

Return Email

X-320M™ will not receive email messages, but when X-320M™ sends email messages, it must include a return email address. This field is used to specify the return email address. Note that although X-320M™ will send email messages with any email address specified in this field, some email filters (spam filters) will not allow messages through that include an invalid email address. There is no default setting for this field.

Email 1 to Email 5

Enter the email addresses of up to five recipients for alarm messages in these fields. There are no default settings for these fields.

Brief Notes About DHCP

All devices on an IP network require an IP address. This is a unique address that identifies each device on the network. DHCP (Dynamic Host Control Protocol) is a mechanism that automatically assigns an IP address to a computer (or other devices) when it is connected to a network. This eliminates the need to manually enter the IP address. When a computer is connected to the network, another device on the network called a DHCP server detects the presence of the computer and dynamically assigns the IP address to that computer. On many small networks, the DHCP server is built into the router.

DHCP works well for "client" devices such as computers, but is not ideal for servers. This is because servers usually don't initiate communications with other devices, but rather they wait for a request from "clients." To make this request, the client must know the IP address of the server. If a server gets its IP address dynamically, the IP address may not always be the same so client devices may not be able to find the server. For this reason, servers usually use an IP address that is fixed and does not change. X-320M™ is a server and manual IP address assignment is usually recommended.

2.4.3 Advanced Network Tab

Note: These settings are not used for most installations.

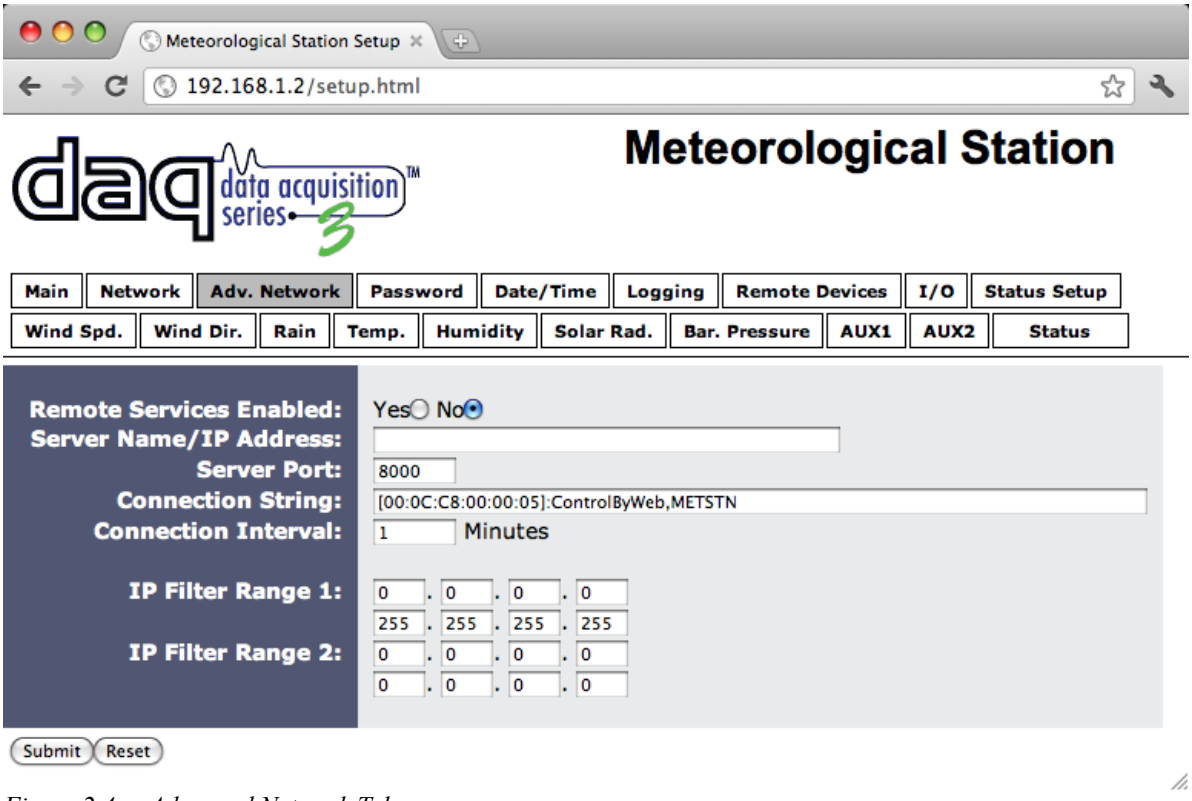


Figure 2.4c - Advanced Network Tab

Remote Services Enabled

This option enables or disables Remote Services. If ***Yes*** is selected, Remote Services will be enabled as soon as the submit button is pressed and X-320M™ will immediately attempt to make a connection with the remote server (power cycle not required). Once a connection is established, the connection will remain until it is disconnected by the remote server. Proper connection with the remote server can be verified by viewing the system status log file (see **Appendix E: Log Files**). The default setting for this field is ***No***. Most users should leave this setting at its default. (See **Remote Services** at the end of this section for more information.)

Server Name/IP Address

Specify the name or IP address of the Remote Services server here. If the IP address is specified, enter it in the format aaa.bbb.ccc.ddd. For numbers that are less than 100, preceding zeros should not be included (for example, enter 80 rather than 080). This field can be up to 40 characters long and has no default setting.

Server Port

Enter the TCP port used for the Remote Services server. This can be set within the range of 0-65535. The default setting for this field is 8000.

Connection String

This text is sent to the Remote Services server when the connection is established. This string should include any information required by the server at connection. For example, it may include an ID number, customer number, password, etc. The format is entirely dependent upon the server requirements. This field can be up to 80 characters long. Default text is provided only as an example placeholder. The default text is [<Serial Number>]:ControlByWeb,METSTN.

Connection Interval

This field specifies the periodic interval in which X-320M™ attempts to connect to the remote server, or if X-320M™ is already connected, it is the interval in which X-320M™ sends the connection string. This field can be set within the range of 1 to 34452 minutes. The default setting for this field is 1 minute.

IP Filter Range 1 and IP Filter Range 2

For additional security, X-320M™ has a simple built-in firewall. If desired, X-320M™ can be configured to only allow access to client devices (computers, servers, other ControlByWeb™ devices, etc) with certain IP addresses. Two IP address ranges are provided and only client devices with addresses that fall within those two ranges will be allowed access. Devices with IP addresses that fall outside of those ranges will not receive any response from X-320M™. The following are examples.

To allow access from any device (this is the default setting):

IP Filter Range 1: `0.0.0.0`
`255.255.255.255`

IP Filter Range 2: `0.0.0.0`
`0.0.0.0`

To limit access to only one device (address 192.168.1.33):

IP Filter Range 1: `192.168.1.33`
`192.168.1.33`

IP Filter Range 2: `0.0.0.0`
`0.0.0.0`

To limit access to only devices on the local network and one device on the internet (address 10.143.100.32):

IP Filter Range 1: `192.168.1.0`
`192.168.1.255`

IP Filter Range 2: `10.143.100.32`
`10.143.100.32`

Note: The address specified for the Remote Services server (if applicable) is automatically allowed through the firewall no matter how the filter is set.

Remote Services

Remote Services initiates an outgoing connection to a server at a remote location. This can be used in an environment where a web server on the Internet provides a custom web page to X-320M™ and other ControlByWeb products. Users access X-320M™ through the web server rather than communicating directly with it. This method is sometimes referred to as “web services” and allows programmers to create powerful, custom web pages to control multiple devices using the web programming languages of their choice.

Remote Services initiates the connection to the external web server (rather than the web server initiating communications to X-320M™). This has two main benefits. First, the web server does not need to know the IP address of X-320M™. This means that X-320M™ can get its IP address dynamically from a DHCP server, simplifying the installation. Second, since the connection from X-320M™ is outgoing, rather than incoming, the local router on the network where X-320M™ resides doesn't need to be configured to forward sockets. This also simplifies the installation. Since the router configuration is not modified, the risk of compromising security on the local network is eliminated.

2.4.4 Password Tab

X-320M™ requires a password to log into the setup pages. The password can be changed on this page. Additionally, a password can be enabled for the **Control Page**.

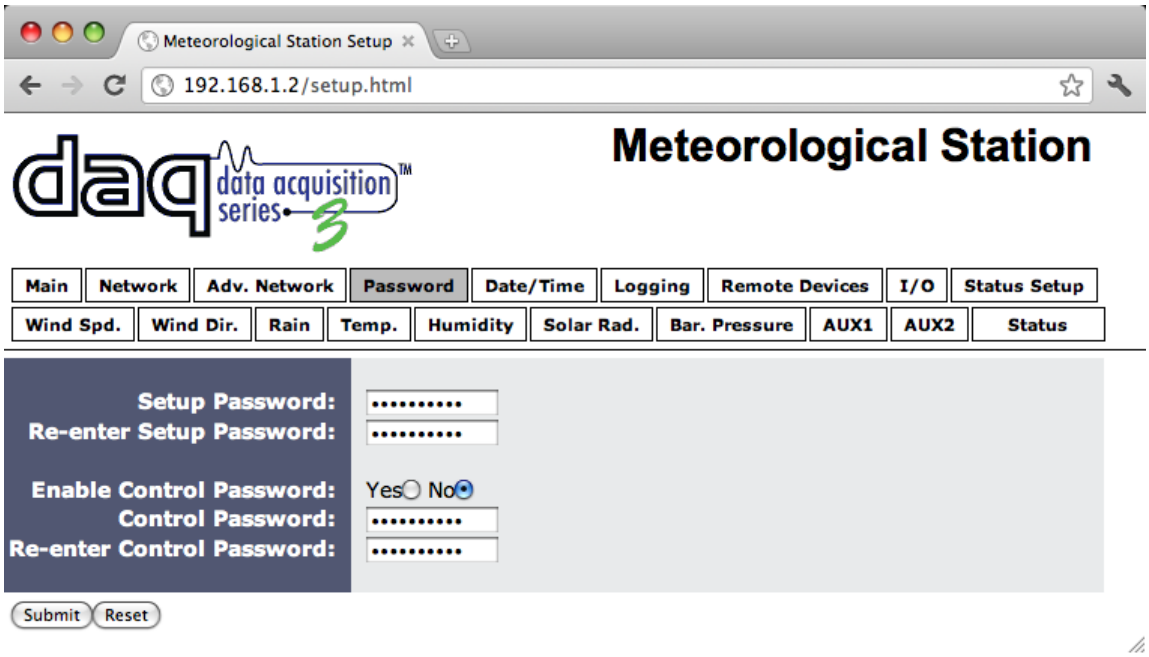


Figure 2.4d - Password Tab

Setup Password

The Setup Password, which is required to access the setup pages, can be modified by entering a new password here. Passwords that are 8 characters or longer with both alphabetic and numeric characters are recommended. For security purposes, the password will not be displayed as it is entered. Note that the username required for accessing the setup pages is `admin` (all lower case). The default Setup Password is `webrelay` (also all lower case). Up to 13 characters can be entered in this field.

Re-enter Setup Password

When the Setup Password is changed, it must be entered twice. One time in the previous field and a second time in this field. If the password is not entered identically in both fields, the password will not be changed.

Enable Control Password

The **Control Page** can be viewed without entering a password. For security purposes, a password can be required for access to the **Control Page**. When this field is set to ***Yes***, a password will be required to view the **Control Page**. The default setting for this field is ***No***.

Control Password

When the Enable Control Password option is set to ***Yes***, this field is used to specify the password which will be required to access the **Control Page**. Passwords that are 8 characters or longer with both alphabetic and numeric characters are recommended (up to 13 characters can be entered in this field). For security purposes, the password will not be displayed as it is entered. Note that X-320M™ requires a password, but does not require a user name to access the **Control Page**. However, some browsers require that a user name be entered. In this instance, enter `none` as the user name. The default Control Password is `webrelay`.

Re-enter Control Password

When the Control Password is changed, it must be entered twice. One time in the previous field, and a second time in this field. If the password is not entered identically in both fields, the password will not be changed.

2.4.5 Date/Time Tab

X-320M™ uses the time for logging (a time stamp is included with each logged event). The time is stored and displayed in 24-hour time format. X-320M™ has a capacitor-backed real-time-clock circuit that will keep track of time for several days in the event of a power failure.

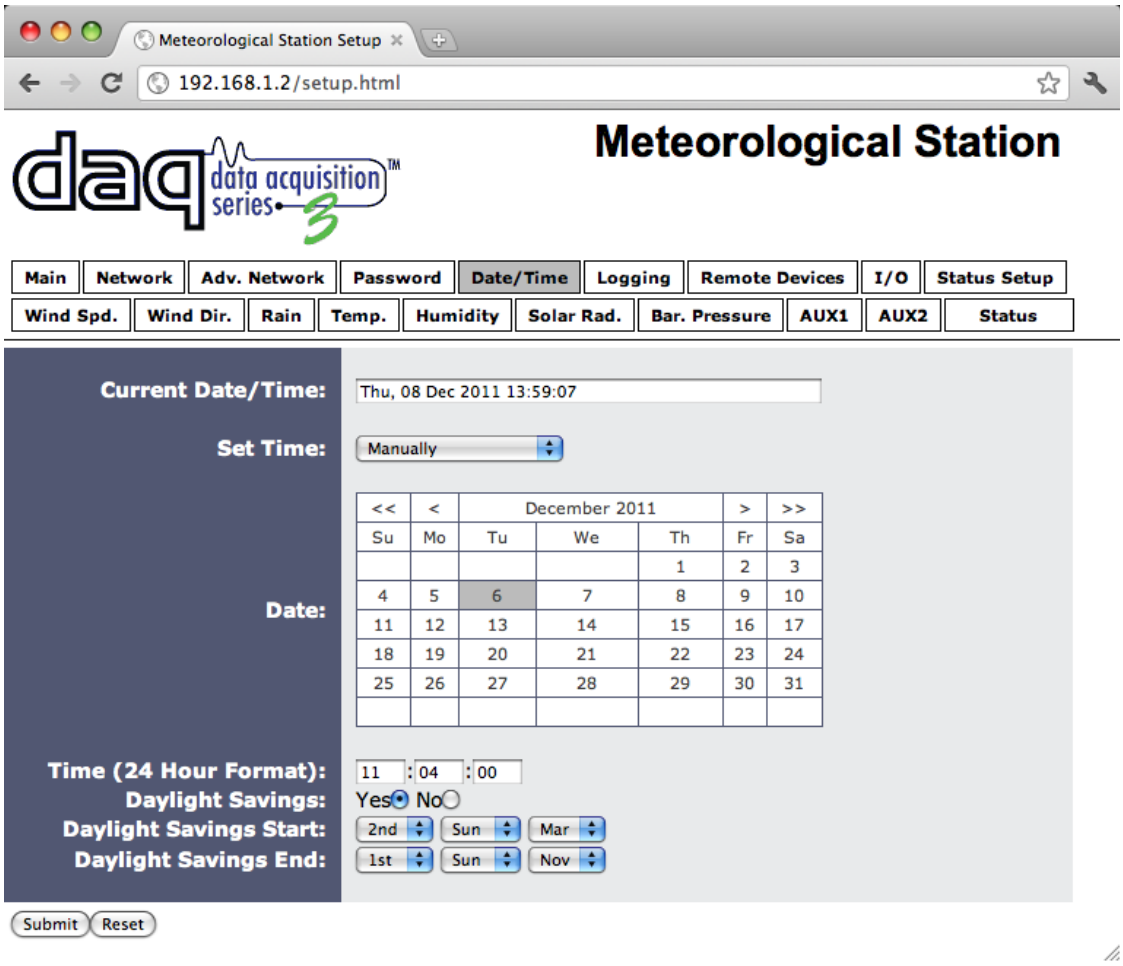


Figure 2.4e - Date/Time Tab - Set Time Manually

Current Date/Time

This is the current date and time stored in X-320M™. The time is stored and displayed in 24-hour format.

Set Time

This drop-down list offers two options for setting the time: ***Manually*** or ***Sync with NTP server***.

The options that follow this field will change based upon how this option is set.

- ***Manually*** requires the user to enter the time and date.
- ***Sync with NTP server*** allows the user to set the clock automatically by using an NTP (Network Time Protocol) server.

Manual Time Configuration

Date

The current date is entered by first selecting the correct month and year, using the left and right arrows at the top of the calender. The single arrows (< and >) change the month and the double arrows (<< and >>) change the year. Once the current month and year are displayed, select the correct day, which will then be highlighted.

Time (24 Hour Format)

Enter the time as HH:MM:SS. (HH represents hours in 24-hour format [00-23], MM represents minutes [00-59], SS represents seconds [00-59].)

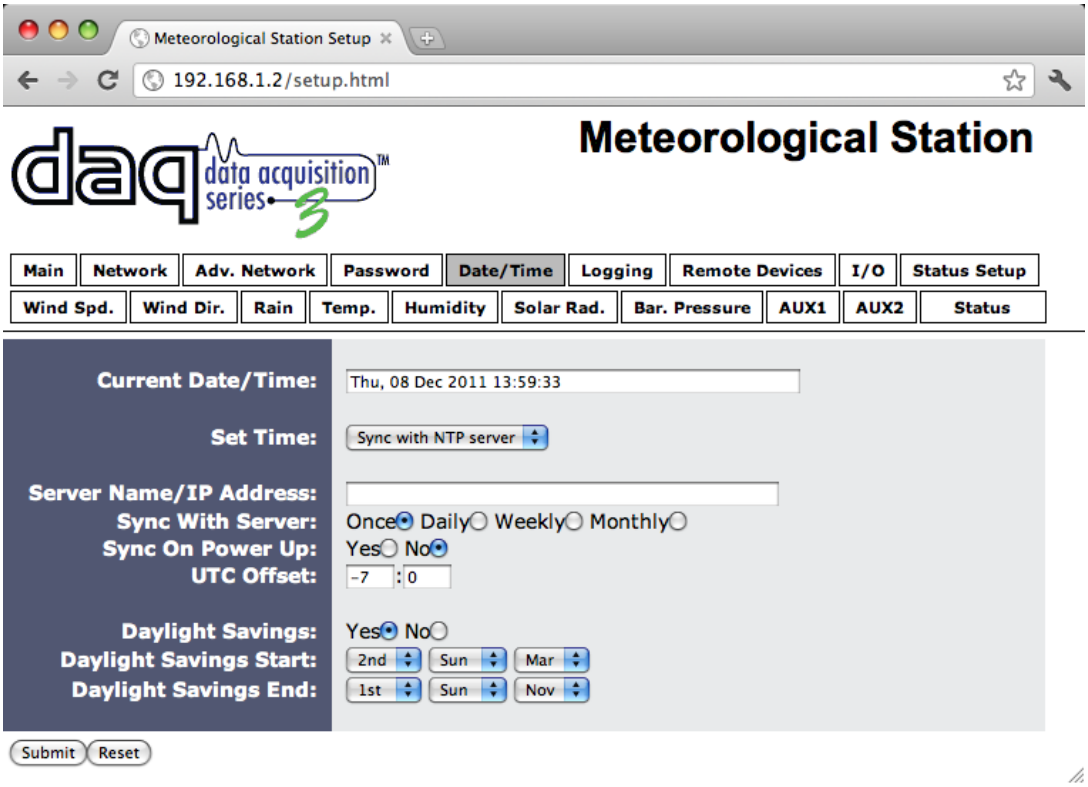


Figure 2.4f - Date/Time Tab - Sync with NTP Server

NTP Time Configuration

Server Name/IP Address

This field is used to specify the name or IP address of the NTP server. If a name is specified, a working DNS server address must be entered into the Network settings. If the IP address is specified, it should be entered in the format aaa.bbb.ccc.ddd, where each of the letters represents a number between 0 and 255. This field can be up to 40 characters. There is no default value for this field.

Many NTP Internet servers are available. In addition, many desktop computers will function as an NTP server (both Mac and PC). If a desktop computer is used, firewall settings may need to be adjusted to allow for NTP communications on port 123.

Public NTP servers can be found at www.pool.ntp.org. Some of these are listed below.

US Servers (http://www.pool.ntp.org/zone/us):
0.us.pool.ntp.org
1.us.pool.ntp.org
2.us.pool.ntp.org
3.us.pool.ntp.org

North America (http://www.pool.ntp.org/zone/north-america):
0.north-america.pool.ntp.org
1.north-america.pool.ntp.org
2.north-america.pool.ntp.org
3.north-america.pool.ntp.org

Europe (http://www.pool.ntp.org/zone/europe):
0.europe.pool.ntp.org
1.europe.pool.ntp.org
2.europe.pool.ntp.org
3.europe.pool.ntp.org

Australia (http://www.pool.ntp.org/zone/au):
0.au.pool.ntp.org
1.au.pool.ntp.org
2.au.pool.ntp.org
3.au.pool.ntp.org

South America (http://www.pool.ntp.org/zone/south-america):
0.south-america.pool.ntp.org
1.south-america.pool.ntp.org
2.south-america.pool.ntp.org
3.south-america.pool.ntp.org

Africa (http://www.pool.ntp.org/zone/africa):
1.africa.pool.ntp.org
1.pool.ntp.org
3.pool.ntp.org

Sync With Server

This option allows the user to specify how often the time on X-320M™ will be synchronized with the time server. When the submit button on this page is pressed, X-320M™ will immediately synchronize with the time server. If Daily, Weekly, or Monthly options are selected, X-320M™ will thereafter re-synchronize with the time server at the period interval specified starting at 12:00 AM (00:00).

The exact time the NTP Request occurs is 12:00 AM (00:00) plus the minute equivalent of the last two digits in the models serial number. For example, if the last two digits in the model's serial number were -09, the NTP Request will occur 9 minutes after 12:00 AM. The default value of this setting is Once (the unit will immediately sync with the NTP server, but will not automatically sync again).

Sync on Power Up

When this option is set to ***Yes,*** X-320M™ will be synchronized with the time server each time it is powered.

Note: If X-320M™ will lose power on a frequent basis, it may be beneficial to set this option to ***No,*** *as some servers are configured to dis-allow access from client devices that excessively request their services. The default value of this setting is* ***No.***

UTC Offset

Time servers return the current time in Universal Time (GMT). It is common for many servers and data loggers to use GMT as their official time, even when they are not located within the GMT time zone. The default value for this field is -7 (Mountain Standard Time). For convenience, the time can be converted to local standard time by entering the offset here. This manual cannot include the UTC Offset for all parts of the world, but the offset for GMT time and the four major US Time zones are listed here.

GMT Time: 0
Eastern Standard Time: -5
Central Standard Time: -6
Mountain Standard Time: -7
Pacific Standard Time: -8

Daylight Savings

In many parts of the United States and in some other countries, the time is shifted forward by one hour during the summer months. This is an effort to conserve energy by making the daylight last longer into the evening hours. If this option is set to ***Yes***, the time on X-320M™ will automatically be shifted forward by one hour at 12:02 AM (00:02) on the Daylight Savings Start date set below, and it will shift back to standard time at 12:02 AM (00:02) on the Daylight Savings End date set below. The default setting is ***Yes***.

Note: Logged data includes a time stamp based upon the current time in the device, so it is possible to duplicate log times in the spring and miss log times in the fall when daylight savings time adjustment is enabled. To avoid confusion, many servers and data loggers are set to remain on GMT time and do not shift for daylight savings.

Daylight Savings Start

This is the date that daylight savings will start. Note that on this date at 12:02 AM (00:02), the current time will be shifted forward by one hour (time will jump from 12:02 AM [00:02] to 1:02 AM [01:02]). By default this is set to the 2nd Sunday in March, which is the date used in the United States.

Daylight Savings End

This is the date that daylight savings will end. On this date at 12:02 AM (00:02), the current time will be shifted backward by one hour (time will jump from 12:02 AM [00:02] to 11:02 PM [23:02] the day before). By default this is set to the 1st Sunday in November, which is the date used in the U.S.

2.4.6 Logging Tab

X-320M™ can be configured to record data such as wind speed and direction, temperature, and solar radiation. The logged data is stored in internal non-volatile memory and can be retrieved by entering the command `http://{X-320M IP address}/log.txt`. For more information on logging, see **Appendix E: Log Files**.

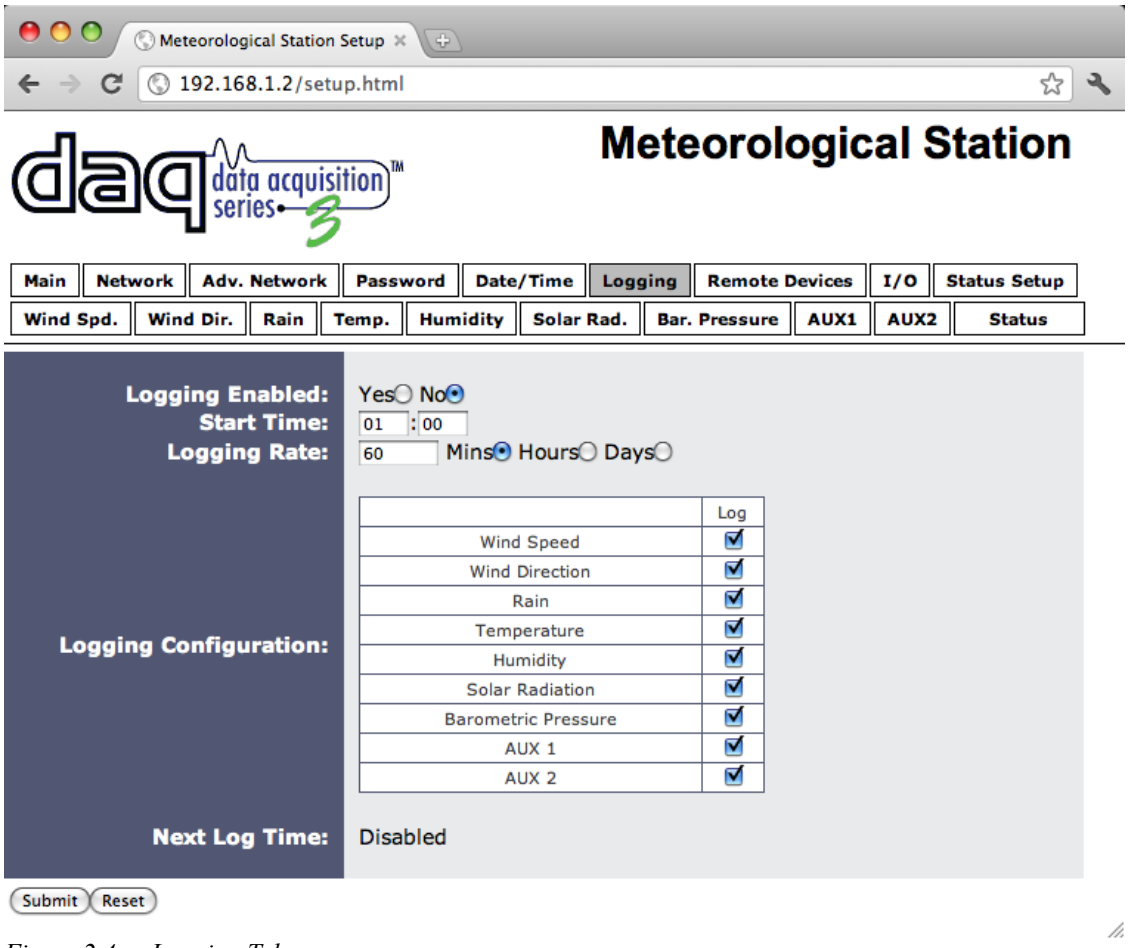


Figure 2.4g - Logging Tab

The log is stored in non-volatile, flash memory using a circular buffer (old date is over written). 512 kB of memory space is reserved for logging. Log entries are composed of the following components: 8-byte header, and 4 bytes for each log feature selected, except digital I/O, which is only 1 byte. A log of analog input 1 (4 bytes) and digital inputs (1 byte) will occupy 13 bytes per entry.Note: Changing the log settings will erase the current log file.

Logging Enabled

When this option is set to ***Yes***, X-320M™ will record data as configured on this page. The default setting for this option is ***No***.

Note: This option controls data logging, but not system logging. System logging is always enabled.

Start Time

If a periodic logging interval is specified, logging will occur relative to the start time. For example, if

the start time is 01:00 and the logging rate is 6 hours, logging will occur at 01:00, 07:00, 13:00, and 19:00. Start time is specified in 24-hour time format. The default setting for this field is `01:00`.

Logging Rate

This field is used to specify the time period of logging. A numerical value is entered into the text field, and the unit of time is selected using the adjacent radio buttons. Time units are **Minutes**, **Hours**, and **Days**. The range of values in this field is `1` to `20864`. The default setting for this field is `60`.

Logging Configuration

This table is used to select which weather information is logged. The first column in the table identifies the type of information that can be logged. The second column is used to specify what is actually logged. All weather information is set to `log` by default.

Next Log Time

This field displays the next periodic log time. If logging is disabled, the Next Log Time will indicate "Disabled."

Note: This information is updated only when the page is refreshed.

2.4.7 Remote Devices Tab

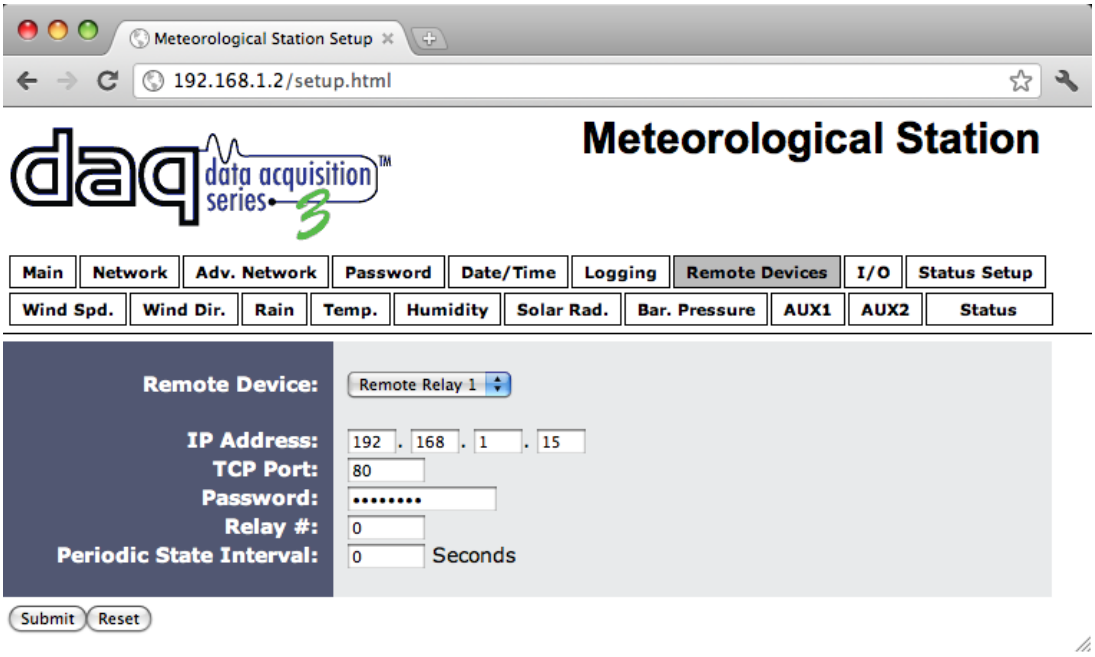


Figure 2.4h - Remote Devices Tab

Remote Device

This option allows you to select which remote device the following settings will apply. You can configure up to three remote devices.

- **Remote Relay 1-2:** This allows you to select either Remote Relay 1 or Remote Relay 2. *Note: Remote Relay 1 and 2 can be separate remote devices.*
- **Remote Analog:** This allows you to receive analog data from another ControlByWeb devices that features Analog Inputs, such as the X-320, X-320M, or Analog Module. Up to 4 single-ended analog inputs from a device can be read.

IP Address

The IP address of the remote device is entered here. The default value is `192.168.1.15`.

TCP Port

The TCP port number used to access the remote device is entered here. This must match the TCP port (HTTP port) set in the remote device. The valid range is `0` to `65530`. The default port number is `80`.

Password

If the remote device requires a password for control, the password must be entered here.

Relay #

The remote device may have multiple relays. This field is used to identify the specific relay to be controlled on the remote device. If the remote device is a single WebRelay™, this field should be zero. If the remote device has multiple relays, this field should be set to the relay number. For example, if relay 2 is to be controlled on another ControlByWeb™ product, the Relay # would be set to 2. This field can be set from 0 to 255.

Periodic State Interval

When X-320M™ is configured to control a remote device, or receive analog information from a remote device, a connection is established. If the device does not receive a message for 50 seconds the connection is terminated. In order for the connection to be maintained, a message containing the state of the relay can be sent at a periodic interval. This field sets the time interval at which the message is sent. The default setting is 50 seconds, thus just maintaining the connection. If the connections should not be maintained, enter a value of 0. This field may be set to 0 or 5-50 seconds.

2.4.8 I/O Tab

This page provides configuration options for the two Digital I/O's built into X-320M™.

The Digital I/O may be configured as inputs or outputs. Different configuration pages are used for each of these modes.

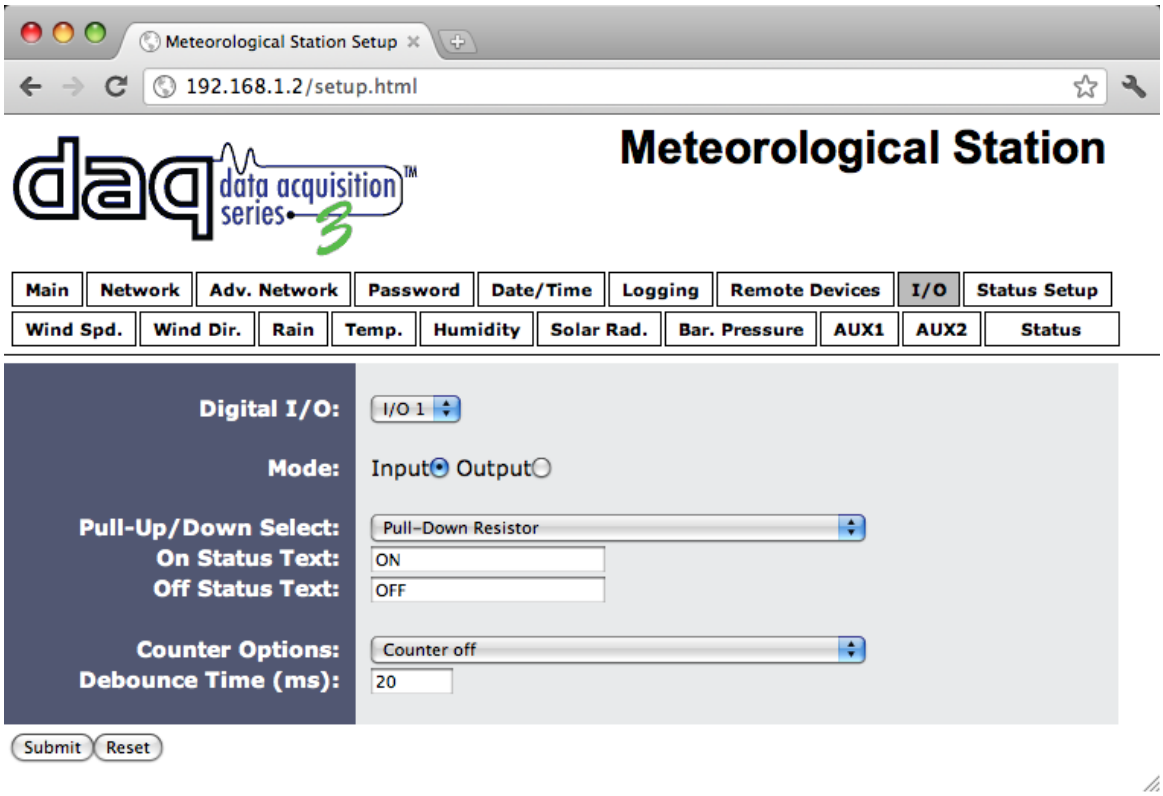


Figure 2.4i - Digital I/O Tab - Input Configuration

Digital I/O

A drop-down menu is used to select the control input to which the options below will apply.

- ***I/O 1*** or ***I/O 2***: Selects the corresponding Digital I/O.

Mode

This selects whether the I/O will function as an **Input** or **Output**.

Input Mode

The following paragraphs describe the Digital Input functions shown in Figure 2.4h.

Pull-Up/Down Select

This drop-down menu is used to configure the On/Off state of the I/O when configured as an input. When **Pull-Up Resistor** is selected, the input will be Off only when tied to ground. When **Pull-Down Resistor** is selected, the input is considered On when 5V is applied to the input.

*Note: The input is considered to be **OFF** when the input is tied to ground.*

Counter Options

The inputs can be used as counters. This field specifies counter operation. Note that the input voltage must remain on or off for the minimum hold time (debounce time) before the counter will be incremented.

- ***Counter off:*** The counter is deactivated and will not be incremented.
- ***Increment when input on:*** Each time the input is considered on, the counter will increment.
- ***Increment when input off:*** Each time the input is considered off, the counter will increment.
- ***Increment when input changes:*** Each time the input changes state, the counter will increment.

Reset Count

The counter will reset to 0 as soon as the count reaches the value specified in this field. The counter is reset immediately when it reaches this value, so this value will never be returned when the counter is read. For example, if the Reset Count is set to 10, the counter will count from 0 to 9 and return to 0 on the next count. This value can be set from `1` to `4,000,000,000`.

Debounce Time (ms)

All mechanical switches exhibit bounce, which means the electrical contacts make and break continuity rapidly when opened or closed. Digital circuits are fast enough to recognize these bounces as switch input activity. Some switches have shorter settling times than others. Solid-state or digital switches, such as signals from another electronic device, do not have any switch bounce.

The Debounce Time sets the minimum hold (debounce) time to allow for mechanical switches to settle in their new state. The default debounce setting is `20` ms, but may be set between `1` and `65535` ms. Due to internal circuit capacitance, the actual minimum is approximately 5 ms.

Note: The debounce time will effectively limit the pulse counter input rate. Users should set the debounce to allow for the maximum expected pulse rate. The debounce should be set to no more that ½ of the maximum expected cycle time. For example, a 100 Hz signal requires a debounce value of 5 ms or less.

Output Mode

The following paragraphs describe the Digital Output mode configuration shown in Figure 2.4j.

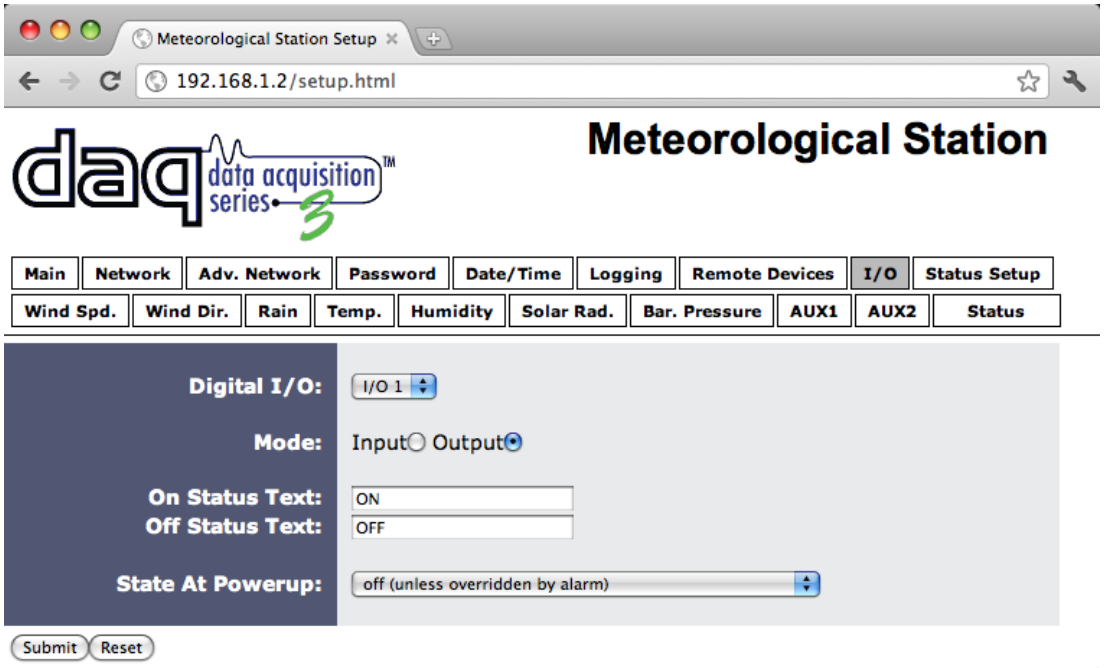


Figure 2.4j - Digital I/O Tab - Output Configuration

State at Powerup

This drop-down menu lets the user specify the state of each of the output when X-320M™ is powered up. The following options can be selected:

- ***off (unless overridden by alarm):*** The output will be off upon power up. This is the default setting.
- ***on (unless overridden by alarm):*** The output will be on when power is applied to X-320M™.
- ***last state (unless overridden by alarm)*****:** Upon power up, the output will return to its last state when X-320M™ was powered off.

2.4.9 Status Setup Tab

This page is used to provide detailed information about the site where X-320M™ is installed, as well as **Status Page** configuration settings.

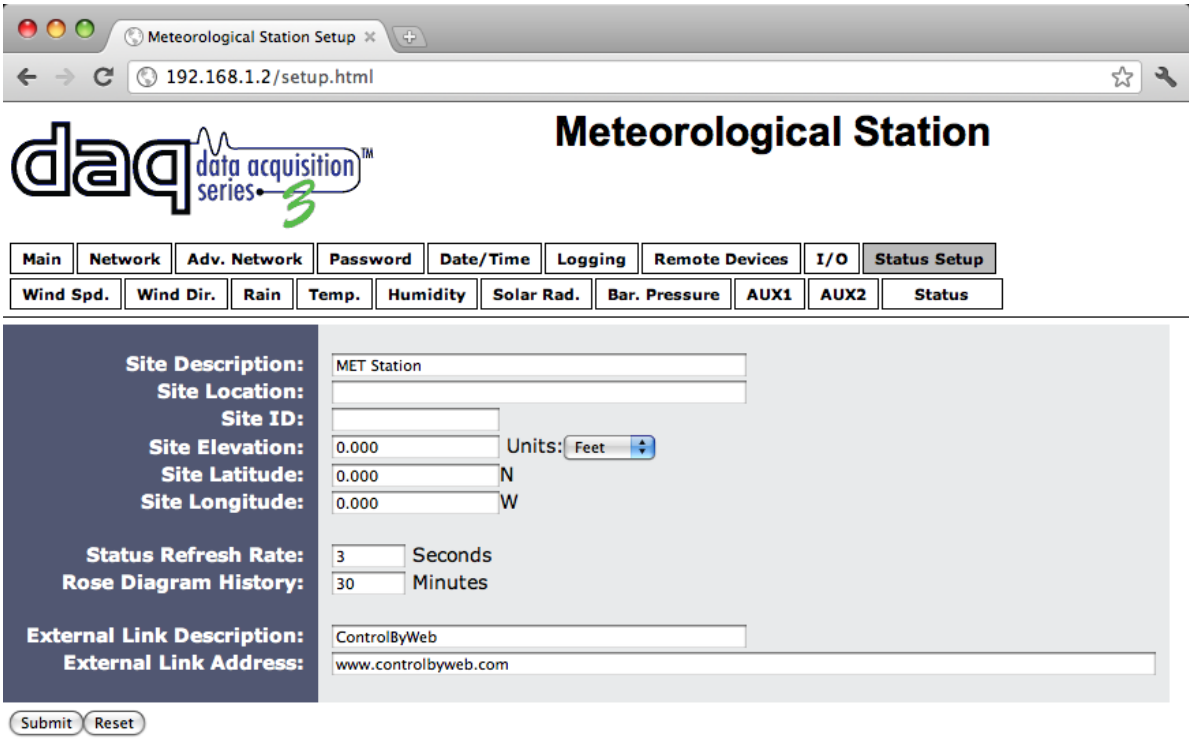


Figure 2.4k - Status Setup Tab

Site Description

This text field is used to describe the site where X-320M™ is installed. It is also the name that appears at the top of the **Status Page** and in email notifications. This field can be up to 40 characters long. The default text for the description is `MET Station`.

Site Location

This text field is used to describe the location where X-320M™ is installed. This field can be up to 40 characters long. There is no default text for this field.

Site ID

This field specifies the Site ID. It can be up to 20 characters long. This field is blank by default.

Site Elevation

This is the elevation of where X-320M™ is installed. The site elevation is also used when adjusting the barometric pressure reading to sea level.

Site Latitude

This field specifies the latitude coordinate of X-320M™.

Site Longitude

This field specifies the longitude coordinate of X-320M™.

Status Refresh Rate

This field specifies how often the **Status Page** will update its contents. The web page will be refreshed automatically at the time interval specified. It can be set from `1` to `32` seconds. The default setting is `3` seconds.

Rose Diagram History

This field specifies how much wind history will be shown by the rose diagram. It can be set from `1` to `60` minutes. The default is `30` minutes.

External Link Description

You can create a customized link to another webpage. For example you could link to a forecast page to display the forecast for the specific location. This text field is used to describe the link to the external web page. The default description is `ControlByWeb`.

External Link Address

This text field is used to provide a direct link to another website or webpage. Up to 96 characters can be entered into this field. The default external link address is `www.controlbyweb.com`.

2.4.10 Wind Speed Tab

This page provides options for configuring the Wind Speed sensor input. Additional information about the Wind Speed calculations can be found in **Appendix F: Methods and Calculation Details**.

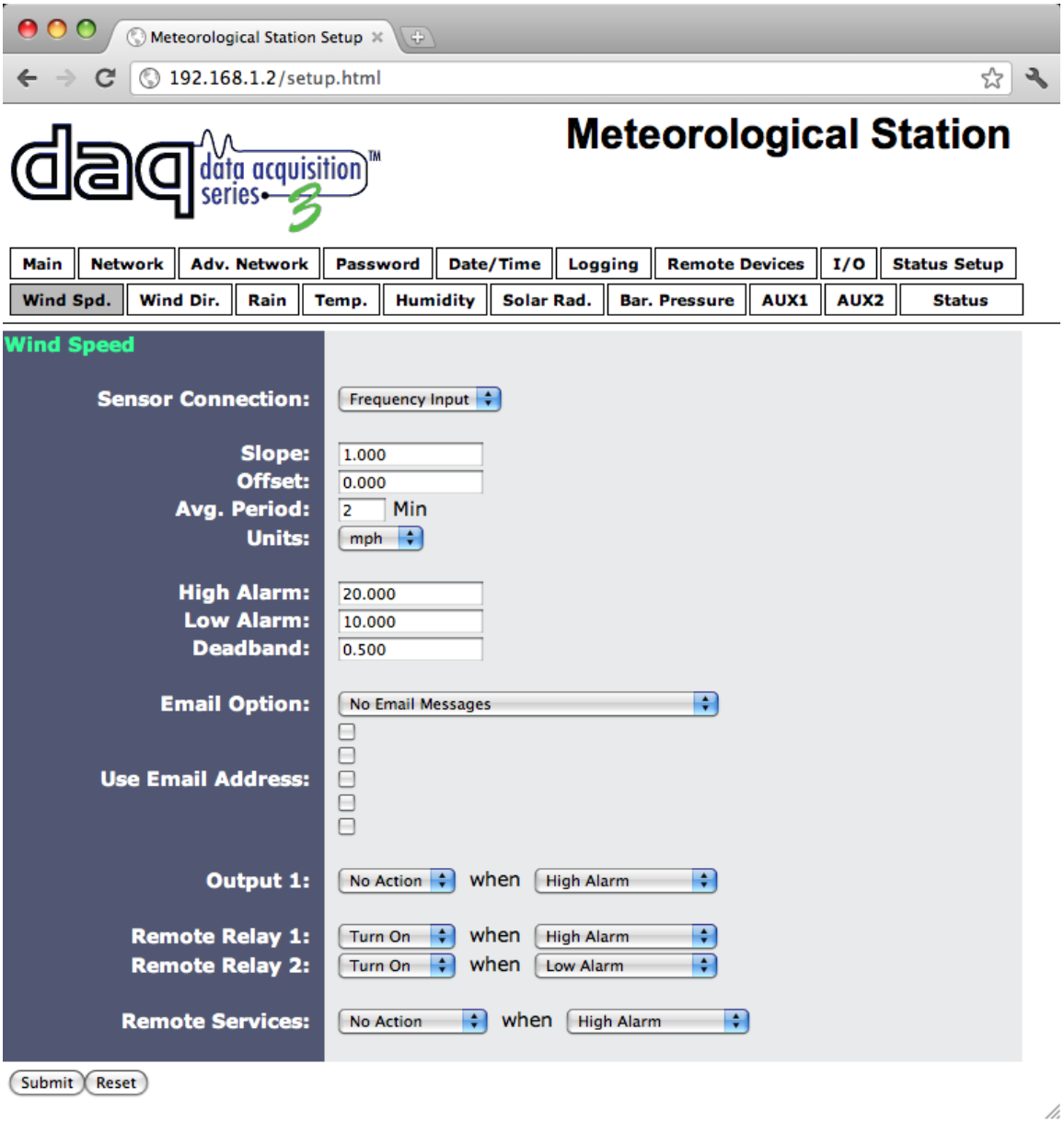


Figure 2.4l - Wind Speed Tab

Sensor Connection

This drop-down menu allows you to select which type of input you are using to monitor wind speed. The following typical sensor connections are available:

- ***None:*** This is used if no sensor is connected to monitor wind speed.
- ***Rate 1-2:*** This is used if the connected sensor outputs a pulse based on wind speed. *Note: Input 1 or 2 must be configured as a counter when using rate.*
- ***Analog 1-4:*** This option is used if the connected sensor outputs an analog value that varies based on wind speed.
- ***Frequency Input*****:** This option is used if the connected sensor outputs a frequency based on the wind speed.
- ***Rmt Analog 1-4:*** This option is used if the connected sensor is an analog sensor that is being read from a remote Analog device, such as another X-320™ or Analog Module.

Slope

In many cases, the inputs must be scaled to represent "real-world" measurements. X-320M™ reads the "raw" value from each input, and calculates the number that represents the "real-world" measurement that the user is actually interested in. This real-world value (referred to as the "Scaled Value" in this manual) is calculated using the following linear formula:

*Scaled Value = Slope * Input + Offset*

The Scaled Value is displayed on the **Status Page.** It is also used to determine alarm conditions, and is shown in email messages.

"Slope" in the formula above is provided by the user and is entered in this field. The value is used to scale the input to the range of detected condition.

The default value for this field is `1`.

When the Slope is set to 1 and Offset is 0 (default values), the Scaled Value equals the Input Value.

Offset

The "Offset" is used for the "zero" measurement. The default value for this field is `0`. When both the slope and offset are set to their default values, the Scaled Value equals the Raw Input.

Avg. Period

The Average Period is the length of time used to average the Scaled Value. For example, if the Average Period is set to 5 minutes, X-320M™ will keep track of the last 150 samples (30 samples/min) and average them over the 5 minute period. If the Average Period is set to zero, no averaging will be used. The Average Period can be set from `0` to `10` minutes. The default Average Period is `2` minutes.

Note: Wind Direction and Wind Speed share the same average period. Making a change to the average period in ***Wind Speed*** *tab will result to the same change to the Average Period in* ***Wind Direction*** *tab.*

Note: If the Average Period is set to zero, then the ***Status Page*** *will not show a Wind Gust value.*

Units

This drop-down allows you to specify the units of measure for the wind speed sensor. The units selected will be determined by the Slope and Offset used to calibrate the sensor. The following options are available:

- ***mph:*** This option is used if you are measuring the wind speed in miles per hour.
- ***km/h:*** This option is used if you are measuring the wind speed in kilometers per hour.
- ***m/s:*** This option is used if you are measuring the wind speed in meters per second.
- ***knots:*** This option is used if you are measuring the wind speed in knots.

High Alarm

This setting is used to set the trigger point for a high alarm condition. The alarm is triggered when the value at the sensor exceeds the High Alarm Value. The default High Alarm is `20`.

Low Alarm

This setting is used to set the trigger point for a low alarm condition. The alarm is triggered when the value at the sensor drops below the Low Alarm Value. The default Low Alarm is `10`.

Deadband

The Deadband prevents alarms from triggering excessively when the sensor measurement vacillates around the trigger point.

With High Alarms, the measurement must fall below the High Alarm point minus the Deadband before the High Alarm will be triggered again. Likewise the Deadband on the Low Alarm requires the measurement to rise above the low alarm point plus the Deadband before the Low Alarm will be triggered again.

For example, if the Deadband is set to 5 mph, and a High Alarm occurs at 50 mph, the alarm will not trigger again until the wind speed first drops below 45 mph (50 mph - 5 mph), as shown in the figure below. The default Deadband is `0.50`.

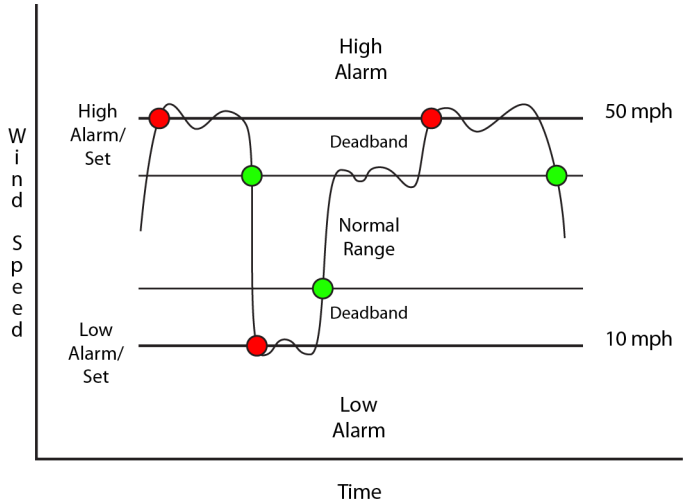


Figure 2.4m - Wind Speed Alarm Deadband

Email Option

Simple email messages can be sent in response to alarm conditions. This parameter is used to specify what alarm conditions, if any, will cause email messages to be sent. Email notification will work only if email is correctly set up in the **Network** setup page.

- ***No Email Messages****:* No email messages will be sent due to alarm conditions.
- ***Send Email on High Alarm***: Email notifications will be sent due to the High Alarm condition.
- ***Send Email on Low Alarm*****:** Email notifications will be sent due to the Low Alarm condition.
- ***Send Email on High and Low Alarm*****:** Email notifications will be sent due to the High and/or Low Alarm condition.
- ***Send Email on High, Low, and Normal*****:** Email notifications will be sent due to the High Alarm, Low Alarm, or when Normal conditions are regained.

Use Email Address

If email messages are to be sent based on alarm conditions, these check boxes specify to which email addresses the message will be sent. Email address specified on the **Network** setup tab will be shown next to each check box.

Output 1 or Output 2 (only shown if one of the Digital I/O's is selected as an output on the I/O setup Tab.)

This field is used to set the action that the corresponding Output will have due to an alarm condition. The first drop-down box specifies the action. The following Actions are available:

- ***No Action:*** No action is taken by the output.
- ***Turn On:*** Turns the output On due to an alarm condition. The output will turn Off when alarm conditions are no longer met.

The second drop-down box specifies the conditions that will cause the action previously specified. The following conditions are available:

- ***High Alarm:*** The specified output action occurs due to the High Alarm.
- ***Low Alarm*****:** The specified output action occurs due to the Low Alarm.
- ***High or Low Alarm:*** The specified output action occurs due to the High and/or Low Alarm.

Remote Relay 1-2

The X-320M™ can be configured to control relays in other ControlByWeb™ products that are located at a remote locations on the network. This field determines the action taken by Remote Relay due to an alarm condition. The following actions are available:

- ***No Action:*** No action is taken by the relay.
- ***Turn On:*** Turns the relay On due to an alarm condition. The relay will turn Off when alarm conditions are no longer met.

The second drop-down box specifies the conditions that will cause the action previously specified. The following conditions are available:

- ***High Alarm:*** The specified relay action occurs due to the High Alarm.
- ***Low Alarm:*** The specified relay action occurs due to the Low Alarm.
- ***High or Low Alarm:*** The specified relay action occurs due to the High and/or Low Alarm.

Remote Services

This field specifies the action with a remote server due to an alarm condition. The following actions are available:

- ***No Action****:* No action is taken.
- ***Send Message***: state.xml will be sent to the remote server.

The second drop down box specifies the conditions that will cause an alarm trigger. The following conditions are available:

- ***High Alarm****:* The specified action occurs due to the High Alarm.
- ***Low Alarm:*** The specified action occurs due to the Low Alarm.
- ***High or Low Alarm:*** The specified action occurs due to the High and/or Low Alarm.

2.4.11 Wind Direction Tab

This page provides configuration options for configuring the Wind Direction sensor input. Additional information about the Wind Direction calculations can be found in **Appendix F: Methods and Calculation Details**.

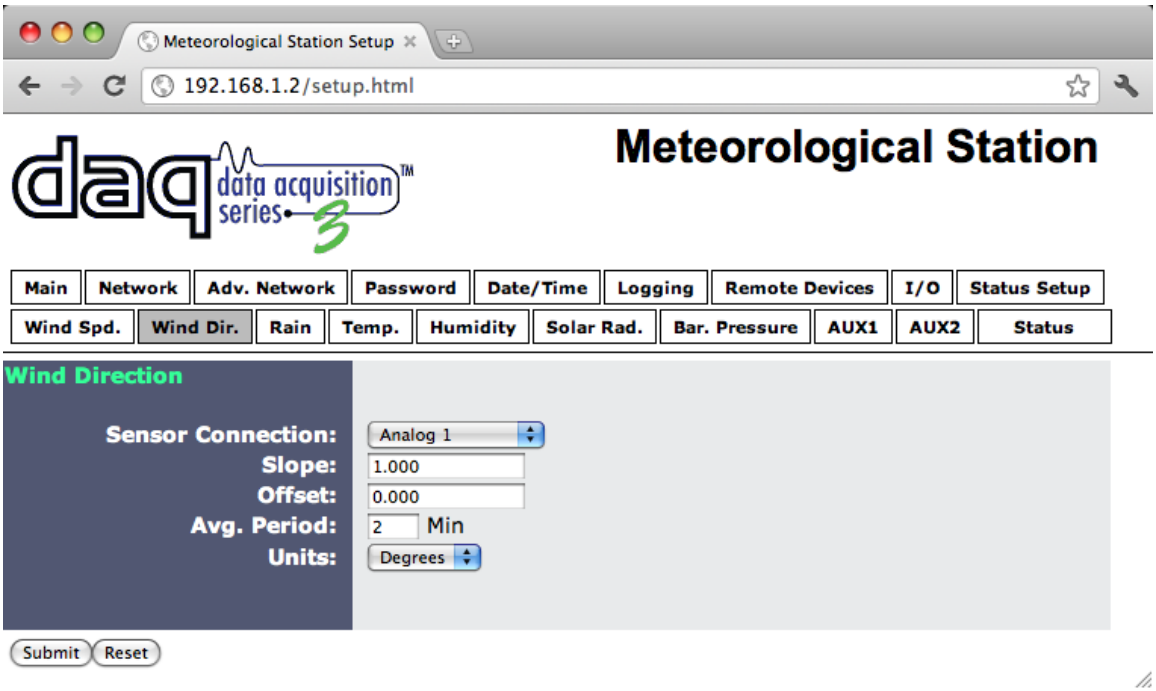


Figure 2.4n - Wind Direction Tab

Sensor Connection

This drop down menu allows you to select which type of input you are using to monitor wind speed. The following typical sensor connections are available:

- ***None:*** This is used if no sensor is connected to monitor wind directions.
- ***Rate 1-2****:* This option is used if the connected sensor outputs a pulse based on the wind direction.
  Note: Input 1 or 2 must be configured as a counter when using rate.
- ***Analog 1-4:*** This option is used if the connected sensor outputs an analog value that varies based on wind direction.
- ***Frequency Input:*** This option is used if the connected sensor outputs a frequency based on the wind direction.
- ***Rmt Analog 1-4:*** This option is used if the connected sensor being used is an analog sensor that is being read from a remote Analog device, such as another X-320™ or Analog Module.

Slope

In many cases, the inputs must be scaled to represent “real-world” measurements. X-320M™ reads the “raw” value from each input, and calculates the number that represents the “real-world” measurement that the user is actually interested in. This real-world value (referred to as the “Scaled Value” in this manual) is calculated using the following linear formula:

*Scaled Value = Slope * Input + Offset*

The Scaled Value is displayed on the **Status Page.** It is also used to determine alarm conditions, and is shown in email messages.

“Slope” in the formula above is provided by the user and is entered in this field. The value is used to scale the input to the range of detected condition.

The default value for this field is `1`.

When the Slope is set to 1 and Offset is 0 (default values), the Scaled Value equals the Input Value.

Offset

The “Offset” is used for the “zero” measurement. The default value for this field is `0`. When both the slope and offset are set to their default values, the Scaled Value equals the Raw Input.

Avg. Period

The Average Period is the length of time used to average the Scaled Value. For example, if the Average Period is set to 5 minutes, X-320M™ will keep track of the last 150 samples (30 samples/min) and average them over the 5 minute period. If the Average Period is set to zero, no averaging will be used. The Average Period can be set from `0` to `10` minutes. The default Average Period is `2` minutes.

*Note: Wind Direction and Wind Speed share the same average period. Making a change to the average period in **Wind Speed** tab will result to the same change to the Average Period in **Wind Direction** tab.*

*Note: If the Average Period is set to zero, then the **Status Page** will not show a Wind Gust value.*

Units

Wind direction is measured in degrees.

2.4.12 Rain Tab

This page provides options for configuring the Rain Accumulation sensor input. Additional information about the Rain gauge calculations can be found in **Appendix F: Methods and Calculation Details**.

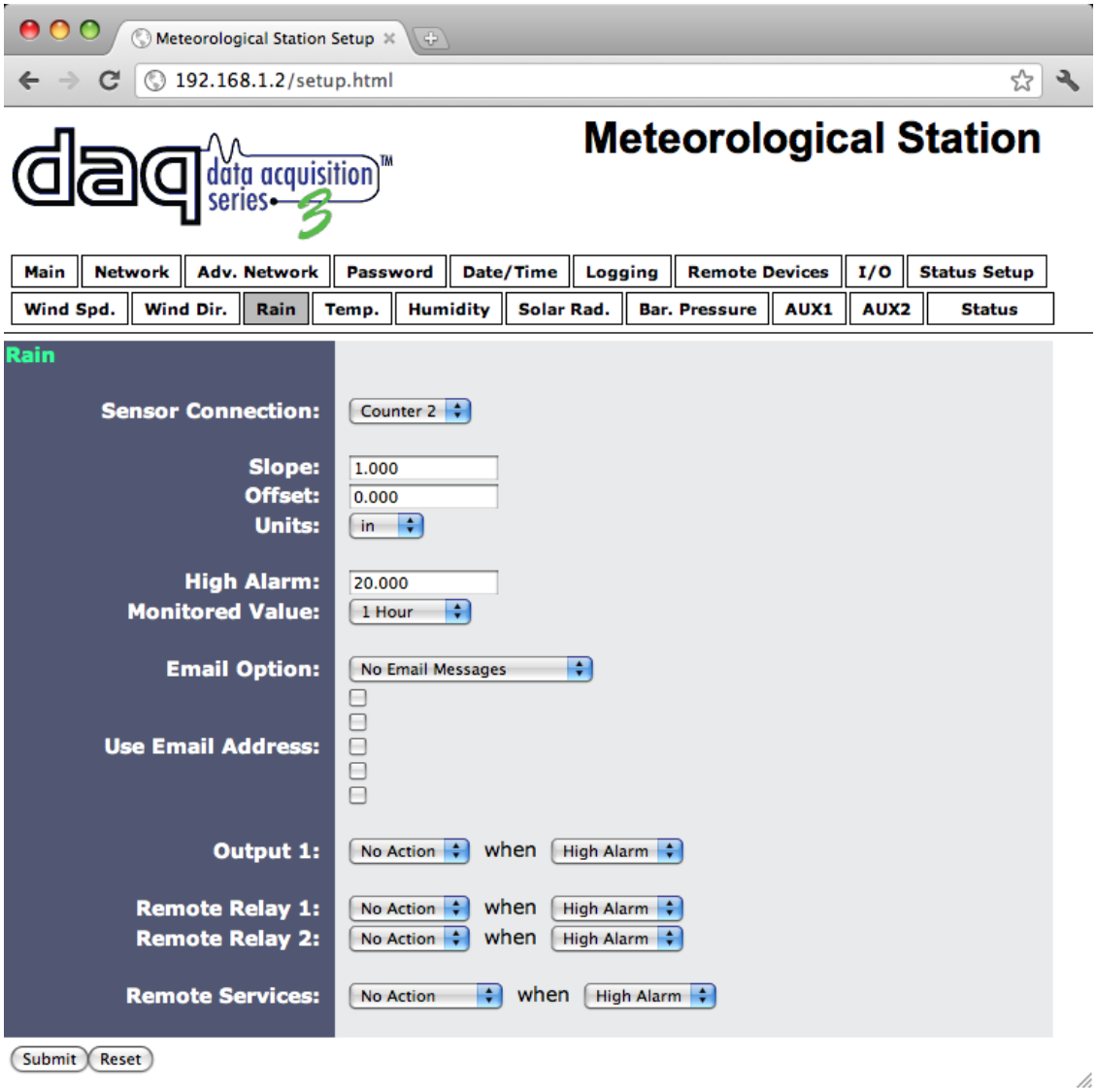


Figure 2.4o - Rain Sensor Tab

Sensor Connection

This drop-down menu allows you to select which type of input you are using to monitor rain accumulation. The following typical sensor connections are available:

- ***None:*** This is used if no sensor is connected to monitor rain accumulation.
- ***Counter 1-2:*** This is used if the connected sensor acts as a counter.
  Note: Input 1 or 2 must be configured as a counter.

Slope

In many cases, the inputs must be scaled to represent “real-world” measurements. X-320M™ reads the “raw” value from each input, and calculates the number that represents the “real-world” measurement that the user is actually interested in. This real-world value (referred to as the “Scaled Value” in this manual) is calculated using the following linear formula:

*Scaled Value = Slope * Input + Offset*

The Scaled Value is displayed on the **Status Page.** It is also used to determine alarm conditions, and is shown in email messages.

“Slope” in the formula above is provided by the user and is entered in this field. The value is used to scale the input to the range of detected condition.

The default value for this field is `1`.

When the Slope is set to 1 and Offset is 0 (default values), the Scaled Value equals the Input Value.

Offset

The “Offset” is used for the “zero” measurement. The default value for this field is `0`. When both the slope and offset are set to their default values, the Scaled Value equals the Raw Input.

Units

This drop-down allows you to specify the units for the wind speed sensor. The units selected will be determined by the slope and offset used to calibrate the sensor. The following units of measure are available:

- ***in:*** This option is used if your Slope and Offset are set to measure rain accumulation in inches.
- ***mm:*** This option is used if your Slope and Offset are set to measure rain accumulation in millimeters.

High Alarm

This setting is used to set the trigger point for a high alarm condition. The alarm is triggered when the value at the sensor exceeds the High Alarm Value. The default High Alarm is `20`.

Monitored Value:

This drop-down menu allows you to select which monitored value will generate the alarm conditions. The Monitored Values are the following:

- ***1 Hour:*** This will generate an alarm if the rain accumulation in the last hour reaches the High Alarm set point.
- ***24 Hour:*** This will generate an alarm if the rain accumulation in the past 24 hours reaches the High Alarm set point.
- ***Last Week:*** This will generate an alarm if the rain accumulation during the last week reaches the High Alarm set point.
- ***Last Month:*** This will generate an alarm if the rain accumulation during the last month reaches the High Alarm set point.
- ***Total Rain:*** This will generate an alarm if the rain accumulation total reaches the High Alarm set point.

Email Option

Simple email messages can be sent in response to alarm conditions. This parameter is used to specify what alarm conditions, if any, will cause email messages to be sent. Email notification will work only if email is correctly set up in the **Network** setup page.

- ***No Email Messages****:* No email messages will be sent due to alarm conditions.
- ***Send Email on High Alarm***: Email notifications will be sent due to the High Alarm condition.

Use Email Address

If email messages are to be sent based on alarm conditions, these check boxes specify to which email addresses the message will be sent. Email addresses specified on the **Network** setup tab will be shown next to each check box.

Output 1 or Output 2 (This option will only appear if one of the Digital I/O's is selected as an output on the I/O tab)

This field is used to set the action that the corresponding Output will have due to an alarm condition. The first drop down box specifies the action. The following Actions are available:

- ***No Action:*** No action is taken by the output.
- ***Turn On:*** Turns the output On due to an alarm condition. The output will turn Off when alarm conditions are no longer met.

The second drop-down box specifies the conditions that will cause the action previously specified. The following conditions are available:

- ***High Alarm:*** The specified output action occurs due to High Alarm.

Remote Relay 1-2

X-320M™ can be configured to control relays in other ControlByWeb™ products that are located at a remote location on the network. This field determines the action taken by Remote Relay due to an alarm condition. The following actions are available:

- ***No Action:*** No action is taken by the relay.
- ***Turn On:*** Turns the relay On due to an alarm condition. The relay will turn Off when alarm conditions are no longer met.

The second drop-down box specifies the conditions that will cause the action previously specified. The following conditions are available:

- ***High Alarm:*** The specified relay action occurs due to the High Alarm.

Remote Services

This field specifies the action with a remote server due to an alarm condition. The following actions are available:

- ***No Action***: No action is taken.
- ***Send Message***: state.xml will be sent to the remote server.

The second drop-down box specifies the conditions that will cause an alarm trigger. The following conditions are available:

- ***High Alarm***: The specified action occurs due to the High Alarm.

2.4.13 Temperature Tab

This page provides options for configuring the Temperature sensor input. Additional information about the Temperature calculations can be found in **Appendix F: Methods and Calculation Details**.

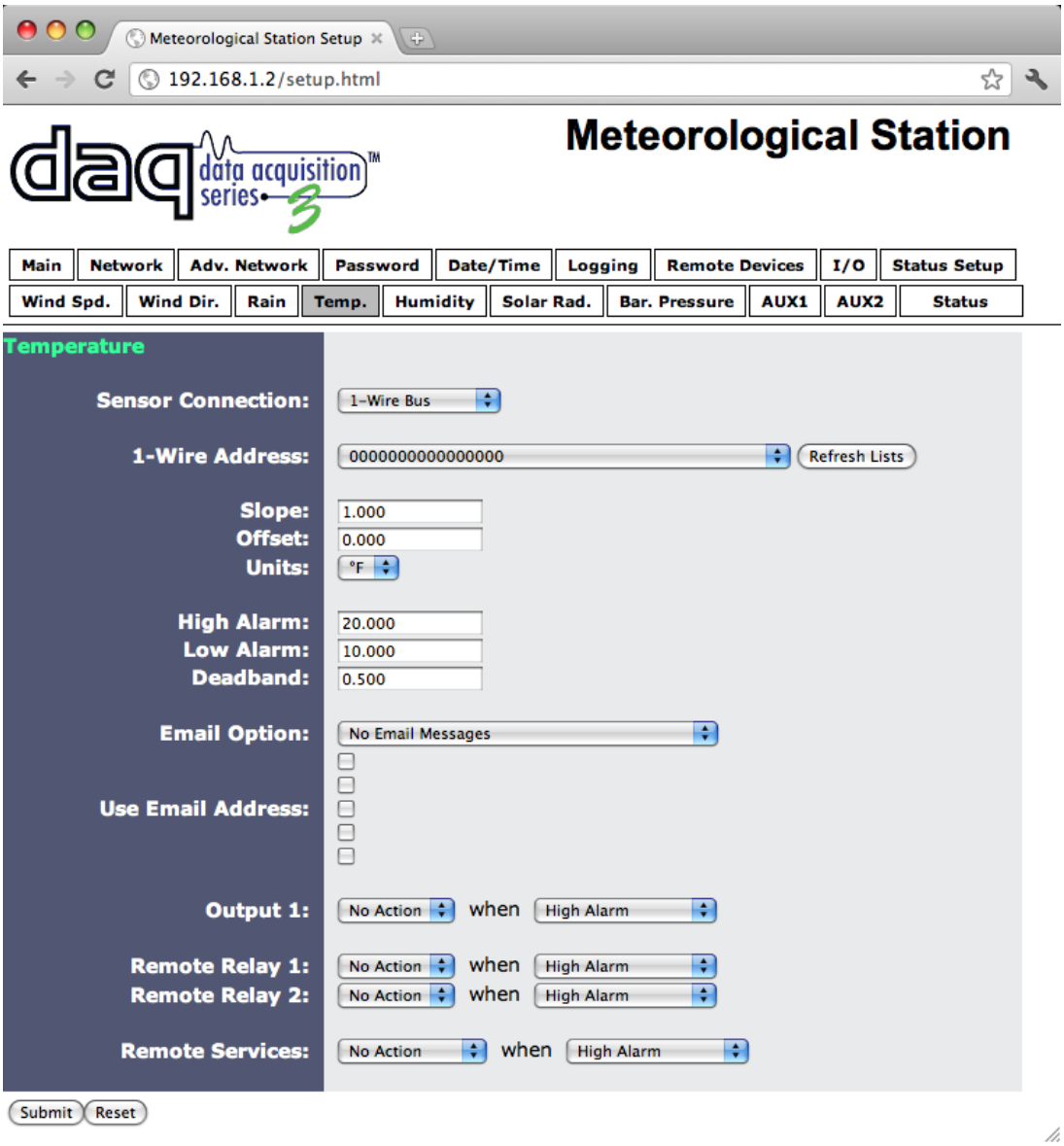


Figure 2.4p - Temperature Tab

Sensor Connection

This drop-down menu allows you to select which type of input you are using to monitor temperature. The following typical sensor connections are available:

- ***None:*** This option is used if no sensor is connected to monitor temperature.
- ***Analog 1-4:*** This option is used if the connected sensor outputs an analog value based on the temperature.
- ***Frequency Input:*** This option is used if the connected sensor outputs a frequency based on

the temperature.

- ***1-Wire Bus:*** This option is used if the connected sensor uses the 1-Wire Bus Protocol to measure temperature.
- ***Rmt Analog 1-4:*** This option is used if the connected sensor is an analog sensor that is being read from a remote Analog device, such as another X-320™ or Analog Module.

1-Wire Address (only shown if 1-Wire Bus is selected in Sensor Connection)

Each 1-Wire sensor comes from the factory with a unique, non-changeable address. When the **Temperature** tab is selected, X-320M™ scans the bus for sensors, the addresses of the sensors that are found on the bus are listed in the drop-down list.

Once a sensor is found on the bus, select the appropriate sensor address from the drop-down list to enable that sensor for temperature measurement.

Note: When the Davis Adapter Kit is used with the Davis Instruments ISS the same 1-Wire address will be used for both temperature and humidity. This is the only case when a 1-wire address is shared.

Slope

In many cases, the inputs must be scaled to represent “real-world” measurements. X-320M™ reads the “raw” value from each input, and calculates the number that represents the “real-world” measurement that the user is actually interested in. This real-world value (referred to as the “Scaled Value” in this manual) is calculated using the following linear formula:

*Scaled Value = Slope * Input + Offset*

The Scaled Value is displayed on the **Status Page.** It is also used to determine alarm conditions, and is shown in email messages.

“Slope” in the formula above is provided by the user and is entered in this field. The value is used to scale the input to the range of detected condition.

The default value for this field is `1`.

When the Slope is set to 1 and Offset is 0 (default values), the Scaled Value equals the Input Value.

Offset

The “Offset” is used for the “zero” measurement. The default value for this field is `0`. When both the slope and offset are set to their default values, the Scaled Value equals the Raw Input.

Units

This drop-down allows you to specify the units of measure for the temperature sensor. The units selected will be determined by the slope and offset used to calibrate the sensor.

The default units for temperature are in Fahrenheit. The following settings should be used:

Slope: 1.00

Offset: 0.00

For Celsius, use the following Slope and Offset:

Slope: 0.555

Offset: -17.777

High Alarm

This setting is used to set the trigger point for a high alarm condition. The number field specifies the temperature at which the alarm is triggered. An alarm is triggered when the sensor reading exceeds the High Alarm value. The default High Alarm is `20`.

Low Alarm

This is a Low Alarm trigger that works similar to the High Alarm. The alarm occurs when the sensor reading falls below the Low Alarm Value. The default Low Alarm is `10`.

Deadband

The Deadband prevents alarms from triggering excessively when the sensor measurement vacillates around the trigger point.

With High Alarms, the measurement must fall below the High Alarm point minus the Deadband before the High Alarm will be triggered again. Likewise, the Deadband on the Low Alarm requires the measurement to rise above the Low Alarm point plus the Deadband before the Low Alarm will be triggered again.

For example, if the Deadband is set to 1 degree, and a High Alarm occurs at 95 degrees, the Deadband ensures that once the High Alarm is triggered, it won't trigger again until the temperature first drops below 94 degrees (95 – 1), as shown in the figure below. The default Deadband is `0.50`.

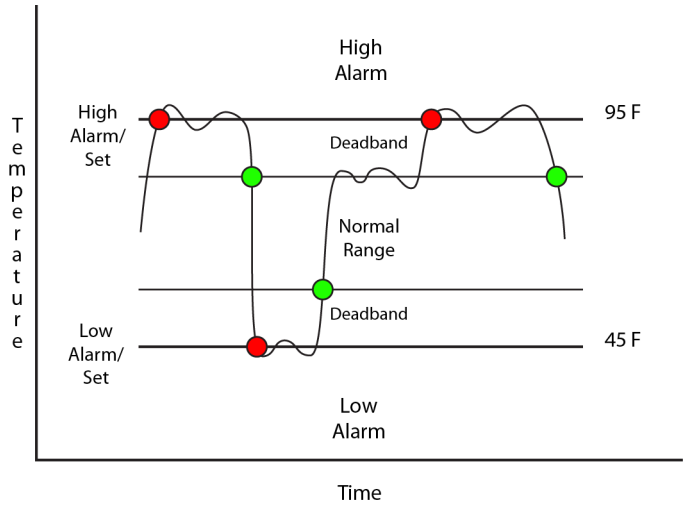


Figure 2.4q - Temperature Alarm Deadband

Email Option

Simple email messages can be sent in response to alarm conditions. This parameter is used to specify what alarm conditions, if any, will cause email messages to be sent. Note that email notification will work only if email is correctly set up in the **Network** setup page.

- ***No Email Messages***: No email messages will be sent due to alarm conditions.
- ***Send Email on High Alarm:*** Email notifications will be sent due to the High Alarm condition.
- ***Send Email on Low Alarm***: Email notifications will be sent due to the Low Alarm condition.
- ***Send Email on High Alarm and Low Alarm***: Email notifications will be sent due to the High and/or Low Alarm condition.
- ***Send Email on a High Alarm, Low Alarm, and Normal***: Email notifications will be sent due to a High Alarm, Low Alarm, or when Normal conditions are regained.

Use Email Address

If email messages are to be sent out based on alarm conditions, these check boxes specify to which email addresses the message will be sent. Email addresses specified on the **Network** setup tab will be shown next to each check box.

Output 1 or Output 2 (This option will only appear if one of the Digital I/O's is selected as an output on the I/O tab)

This field is used to set the action that the corresponding Output will have due to an alarm condition. The first drop down box specifies the action. The following actions are available:

- ***No Action:*** No action is taken by the output.
- ***Turn On:*** Turns the output On due to an alarm condition. The output will turn Off when alarm conditions are no longer met.

The second drop-down box specifies the conditions that will cause the action previously specified. The following conditions are available:

- ***High Alarm:*** The specified output action occurs due to the High Alarm.
- ***Low Alarm:*** The specified output action occurs due to the Low Alarm.
- ***High or Low Alarm:*** The specified output action occurs due to the High and/or Low Alarm.

Remote Relay 1-2

X-320M™ can be configured to control relays in other ControlByWeb™ products that are located at a remote location on the network. The same actions for the local outputs also apply to remotely controlled relays. This field determines the action taken by Remote Relay due to an alarm condition. The following actions are available:

- ***No Action:*** No action is taken by the relay.
- ***Turn On:*** Turns the relay On due to an alarm condition. The relay will turn Off when alarm conditions are no longer met.

The second drop-down box specifies the conditions that will causes the action previously specified. The following conditions are available:

- ***High Alarm:*** The specified relay action occurs due to the High Alarm.
- ***Low Alarm :*** The specified relay action occurs due to the Low Alarm.
- ***High Alarm or Low Alarm:*** The specified relay action occurs due to the High and/or Low Alarm.

Remote Services

This field specifies the action with a remote server due to an alarm condition. The following actions are available:

- ***No Action***: No action is taken.
- ***Send Message***: state.xml will be sent to the remote server.

The second drop-down box specifies the conditions that will cause an alarm trigger. The following conditions are available:

- ***High Alarm***: The specified action occurs due to the High Alarm.
- ***Low Alarm***: The specified action occurs due to the Low Alarm.
- ***High Alarm or Low Alarm***: The specified action occurs due to the High and/or Low Alarm.

2.4.14 Humidity Tab

This page provides options for configuring the Humidity sensor input. Additional information about the Humidity calculations can be found in **Appendix F: Methods and Calculation Details**.

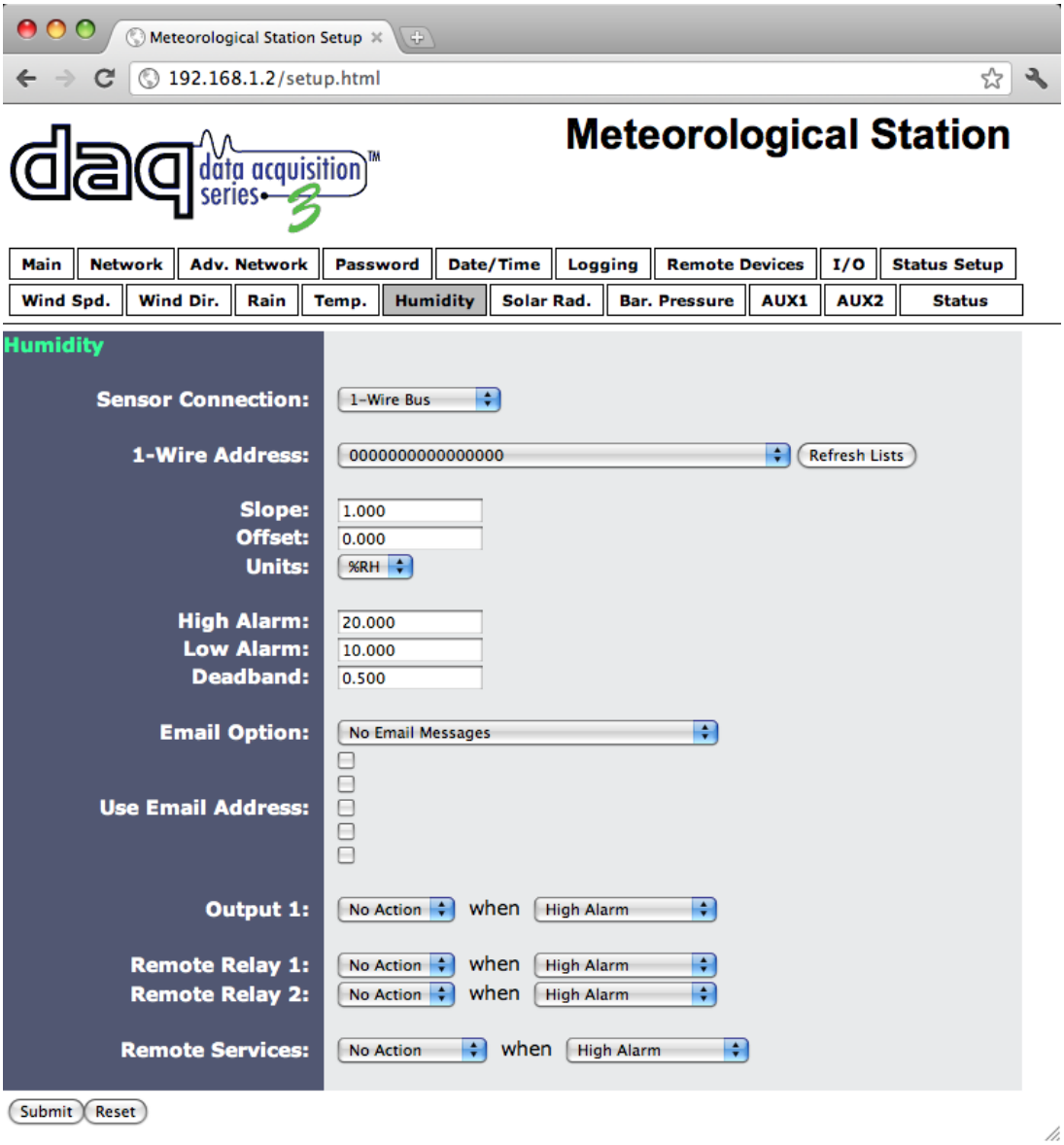


Figure 2.4r - Humidity Tab

Sensor Connection

This drop-down menu allows you to select which type of input you are using to monitor humidity. The following typical sensor connections are available:

- ***None:*** This is used if no sensor is connected to monitor Humidity.
- ***Analog 1-4:*** This option is used if the connected sensor outputs an analog signal based on the humidity.

- ***Frequency Input:*** This option is used if the connected sensor outputs a frequency based on the humidity
- ***1-Wire Bus:*** This is used if the connected sensor uses the 1-Wire Bus Protocol to measure temperature
- ***Rmt Analog 1-4:*** This option is used if the connected sensor is an analog sensor that is being read from a remote Analog device, such as another X-320™ or Analog Module.

1-Wire Address (only shown if 1-Wire Bus is selected in Sensor Connection)

Each 1-Wire sensor comes from the factory with a unique, non-changeable address. When the **Humidity** tab is selected, X-320M™ scans the bus for sensors. The addresses of the sensors that are found on the bus are listed in the drop-down list.

Once a sensor is found on the bus, select the appropriate sensor address from the drop-down list to enable that sensor for humidity measurement.

Note: When the Davis Adapter Kit is used with the Davis Instruments ISS, the same 1-Wire address will be used for both temperature and humidity. This is the only case when a 1-wire address is shared.

Slope

In many cases, the inputs must be scaled to represent “real-world” measurements. X-320M™ reads the “raw” value from each input, and calculates the number that represents the “real-world” measurement that the user is actually interested in. This real-world value (referred to as the “Scaled Value” in this manual) is calculated using the following linear formula:

*Scaled Value = Slope * Input + Offset*

The Scaled Value is displayed on the **Status Page.** It is also used to determine alarm conditions, and is shown in email messages.

“Slope” in the formula above is provided by the user and is entered in this field. The value is used to scale the input to the range of detected condition.

The default value for this field is `1`.

When the Slope is set to 1 and Offset is 0 (default values), the Scaled Value equals the Input Value.

Offset

The “Offset” is used for the “zero” measurement. The default value for this field is `0`. When both the slope and offset are set to their default values, the Scaled Value equals the Raw Input.

Units

The units used for humidity is set to %RH.

High Alarm

This setting is used to set the trigger point for the high alarm condition. The number field specifies the humidity at which the alarm is triggered. The alarm is triggered when the sensor reading exceeds the High Alarm Value. The default High Alarm is `20`.

Low Alarm

This setting is used to set the trigger point for the low alarm condition. The number field specifies the humidity at which the alarm is triggered. The alarm is triggered when the sensor reading falls below the Low Alarm Value. The default Low Alarm is `10`.

Deadband

The Deadband prevents alarms from triggering excessively when the sensor measurement vacillates around the trigger point.

With High Alarms, the measurement must fall below the High Alarm point minus the Deadband before the High Alarm will be triggered again. Likewise, the Deadband on the Low Alarm requires the measurement to rise above the Low Alarm point plus the Deadband before the low alarm will be triggered again.

For example, if the Deadband is set to 5 %RH, and a High Alarm occurs at 80 %RH, the Deadband ensures that once the High Alarm is triggered, it won't trigger again until the humidity first drops below 75 %RH (80 – 5), as shown in the figure below. The default Deadband is `0.50`.

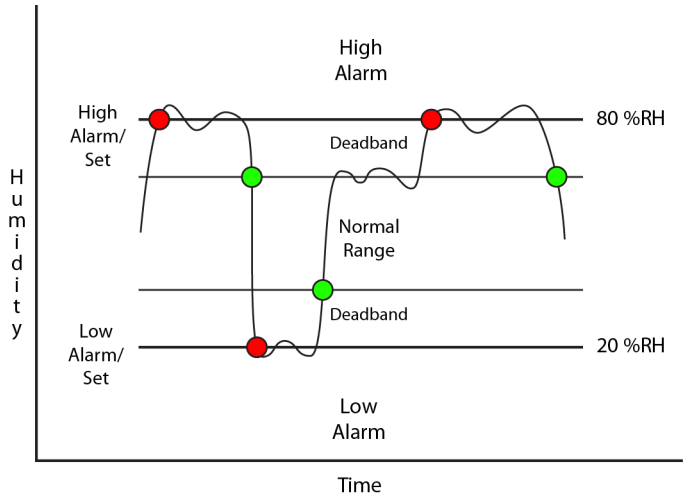


Figure 2.4s - Humidity Alarm Deadband

Email Option

Simple email messages can be sent in response to alarm conditions. This parameter is used to specify what alarm conditions, if any, will cause email messages to be sent. Note that email notification will work only if email is correctly set up in the **Network** setup page.

- ***No Email Messages***: No email messages will be sent due to alarm conditions.
- ***Send Email on High Alarm*** : Email notifications will be sent due to the High Alarm condition.
- ***Send Email on Low Alarm***: Email notifications will be sent due to the Low Alarm condition.
- ***Send Email on High Alarm and Low Alarm***: Email notifications will be sent due to the High and/or Low Alarm conditions.
- ***Send Email on High Alarm, Low Alarm, and Normal***: Email notifications will be sent due to the High Alarm, Low Alarm, or when normal conditions are regained.

Use Email Address

If email messages are to be sent out based on alarm conditions, these check boxes specify to which email addresses the message will be sent. Email addresses specified on the **Network** setup tab will be shown next to each check box.

Output 1 or Output 2 (This option will only appear if one of the Digital I/O's is selected as an output in the I/O tab)

This field is used to set the action that the corresponding Output will have due to an alarm condition. The first drop-down box specifies the action. The following actions are available:

- ***No Action:*** No action is taken by the output.
- ***Turn On:*** Turns the output On due to an alarm condition. The output will turn Off when alarm conditions are no longer met

The second drop-down box specifies the conditions that will cause the action previously specified. The following conditions are available:

- ***High Alarm:*** The specified output action occurs due to the High Alarm.
- ***Low Alarm:*** The specified output action occurs due to the Low Alarm.
- ***High or Low Alarm:*** The specified output action occurs due to the High and/or Low Alarm.

Remote Relay 1-2

X-320M™ can be configured to control relays in other ControlByWeb™ products that are located at a remote location on the network. The same actions for the local outputs also apply to remotely controlled relays. This field determines the action taken by Remote Relay due to an alarm condition. The following actions are available:

- ***No Action:*** No action is taken by the relay.
- ***Turn On:*** Turns the relay On due to an alarm condition. The relay will turn Off when alarm conditions are no longer met.

The second drop-down box specifies the conditions that will causes the action previously specified. The following conditions are available:

- ***High Alarm:*** The specified relay action occurs due to the High Alarm.
- ***Low Alarm:*** The specified relay action occurs due to the Low Alarm.
- ***High Alarm or Low Alarm:*** The specified relay action occurs due to the High or Low Alarm.

Remote Services

This field specifies the action with a remote server due to an alarm condition. The following actions are available:

- ***No Action***: No action is taken.
- ***Send Message***: state.xml will be sent to the remote server.

The second drop-down box specifies the conditions that will cause an alarm trigger. The following alarm conditions are available:

- ***High Alarm***: The specified action occurs due to the High Alarm.
- ***Low Alarm***: The specified action occurs due to the Low Alarm.
- ***High Alarm or Low Alarm***: The specified action occurs due to the High and/or Low Alarm.

2.4.15 Solar Radiation Tab

This page provides options for configuring the Solar Radiation sensor input. Additional information about the Solar Radiation calculations can be found in **Appendix F: Methods and Calculation Details**.

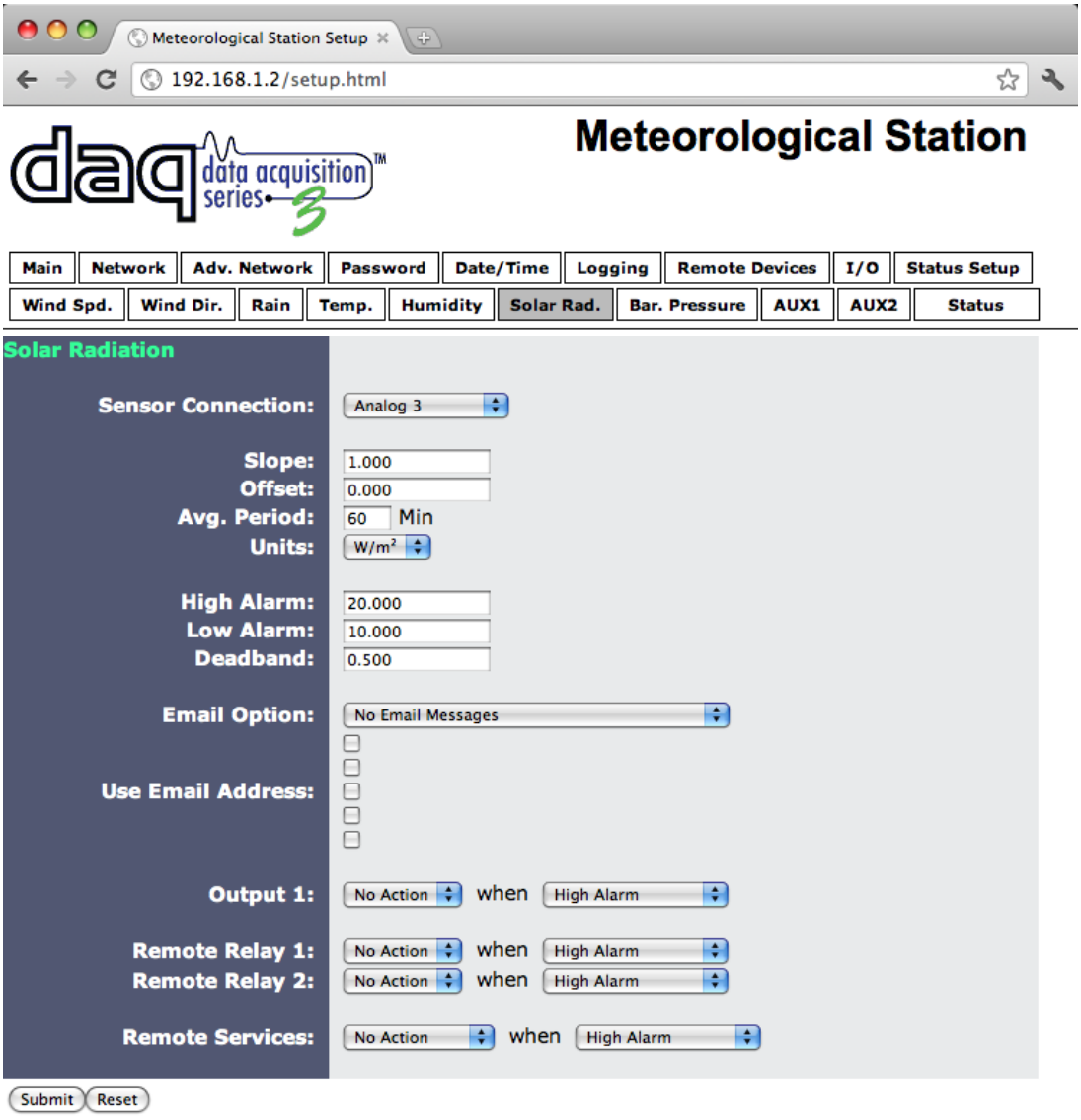


Figure 2.4t - Solar Radiation Tab

Sensor Connection

This drop down menu allows you to select which type of input you are using to monitor wind speed. The typical sensor connection are the following:

- ***None:*** This is used if no sensor is connected to monitor solar radiation.
- ***Rate 1-2:*** This option is used if the sensor connected outputs a pulse based on the solar radiation.
  Note: Input 1 or 2 must be configured as a counter when using rate.
- ***Analog 1-4:*** This option is used if the sensor connected outputs an analog value based on the measured solar radiation.
- ***Rmt Analog 1-4:*** This option is used if the sensor being used is an analog sensor that is being read from a remote Analog device, such as another X-320™ or Analog Module.

Slope

In many cases, the inputs must be scaled to represent "real-world" measurements. X-320M™ reads the "raw" value from each input, and calculates the number that represents the "real-world" measurement that the user is actually interested in. This real-world value (referred to as the "Scaled Value" in this manual) is calculated using the following linear formula:

*Scaled Value = Slope * Input + Offset*

The Scaled Value is displayed on the **Status Page.** It is also used to determine alarm conditions, and is shown in email messages.

"Slope" in the formula above is provided by the user and is entered in this field. The value is used to scale the input to the range of detected condition.

The default value for this field is `1`.

When the Slope is set to 1 and Offset is 0 (default values), the Scaled Value equals the Input Value.

Offset

The "Offset" is used for the "zero" measurement. The default value for this field is `0`. When both the slope and offset are set to their default values, the Scaled Value equals the Raw Input.

Avg. Period

The Average Period is the length of time used to average the Scaled Value. For example, it the Average Period is set to 30 minutes, X-320M™ will keep track of the last 30 samples (1 sample/min) and average them over the 30 minute period. If the Average Period is set to zero, no averaging will be used. The Average Period can be set from `0` to `60` minutes. The default average period is `60` minutes.

Units

The units used to measure Solar radiation is W/m^2.

High Alarm

This setting is used to set the trigger point for a high alarm condition. The alarm is triggered when the value at the sensor exceeds the High Alarm Value. The default High Alarm is `20`.

Low Alarm

This setting is used to set the trigger point for a low alarm condition. The alarm is triggered when the value at the sensor drops below the Low Alarm Value. The default Low Alarm is `10`.

Deadband

The Deadband prevents alarms from triggering excessively when the sensor measurement vacillates around the trigger point.

With High Alarms, the measurement must fall below the High Alarm point minus the Deadband before the high alarm will be triggered again. Likewise, the deadband on the Low Alarm requires the measurement to rise above the Low Alarm point plus the Deadband before the Low Alarm will be triggered again.

For example, if the deadband is set to 50, and a High Alarm occurs at 300 W/m^2, the alarm will not trigger again until the Solar Radiation first drops below 250 W/m^2. (300 W/m^2 - 50 W/m^2), as shown in the figure below. The default Deadband is `0.50`.

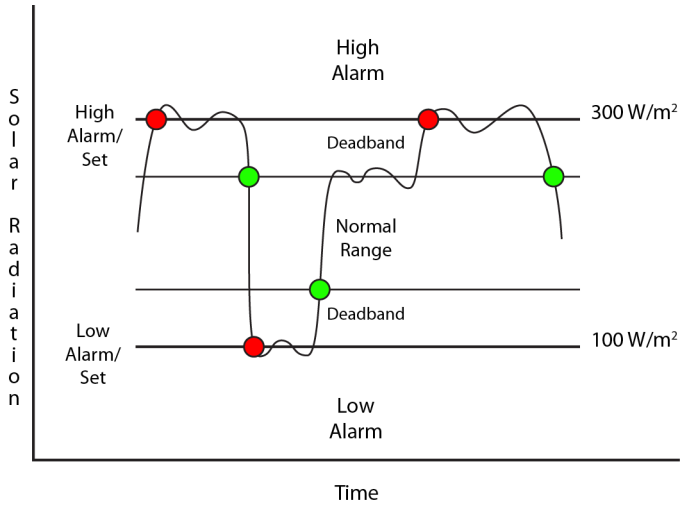


Figure 2.4u -Solar Radiation Alarm Deadband

Email Option

Simple email messages can be sent in response to alarm conditions. This parameter is used to specify what alarm conditions, if any, will cause email messages to be sent. Email notification will work only if email is correctly set up in the **Network** setup page.

- ***No Email Messages****:* No email messages will be sent due to alarm conditions.
- ***Send Email on High Alarm***: Email notifications will be sent due to the High Alarm condition.
- ***Send Email on Low Alarm*****:** Email notifications will be sent due to the Low Alarm condition.
- ***Send Email on High and Low Alarm*****:** Email notifications will be sent due to the High and/or Low Alarm condition.
- ***Send Email on High, Low, and Normal*****:** Email notifications will be sent due to the High Alarm, Low Alarm, or when Normal conditions are regained.

Use Email Address

If email messages are to be sent based on alarm conditions, these check boxes specify to which email addresses the message will be sent. Email addresses specified on the **Network** setup tab will be shown next to each check box.

Output 1 or Output 2 (This option will only appear if one of the Digital I/O's is selected as an output on the I/O tab)

This field is used to set the action that the corresponding Output will have due to an alarm condition. The first drop down box specifies the action. The following actions are available:

- ***No Action:*** No action is taken by the output.
- ***Turn On:*** Turns the output On due to an alarm condition. The output will turn Off when alarm conditions are no longer met

The second drop-down box specifies the conditions that will cause the action previously specified. The following conditions are available:

- ***High Alarm:*** The specified output action occurs due to the High Alarm.
- ***Low Alarm:*** The specified output action occurs due to the Low Alarm.
- ***High or Low Alarm:*** The specified output action occurs due to the High and/or Low Alarm.

Remote Relay 1-2

X-320M™ can be configured to control relays in other ControlByWeb™ products that are located at a remote location on the network. This field determines the action taken by Remote Relay due to an alarm condition. The following actions are available:

- ***No Action:*** No action is taken by the relay.
- ***Turn On:*** Turns the relay On due to an alarm condition. The relay will turn off when alarm conditions are no longer met.

The second drop-down box specifies the conditions that will causes the action previously specified. The following conditions are available:

- ***High Alarm:*** The specified relay action occurs due to the High Alarm.
- ***Low Alarm:*** The specified relay action occurs due to the Low Alarm.
- ***High or Low Alarm:*** The specified relay action occurs due to the High and/or Low Alarm.

Remote Services

This field specifies the action with a remote server due to an alarm condition. The following actions are available:

- ***No Action***: No action is taken.
- ***Send Message***: state.xml will be sent to the remote server.

The second drop-down box specifies the conditions that will cause an alarm trigger. The following conditions are available:

- ***High Alarm***: The specified action occurs due to the High Alarm.
- ***Low Alarm***: The specified action occurs due to the Low Alarm.
- ***High or Low Alarm****: T*he specified action occurs due to the High and/or Low Alarm.

2.4.16 Barometric Pressure Tab

This page provides configuration options for configuring the Barometric Pressure sensor input. Additional information about the Barometric Pressure calculations can be found in **Appendix F: Methods and Calculation Details**.

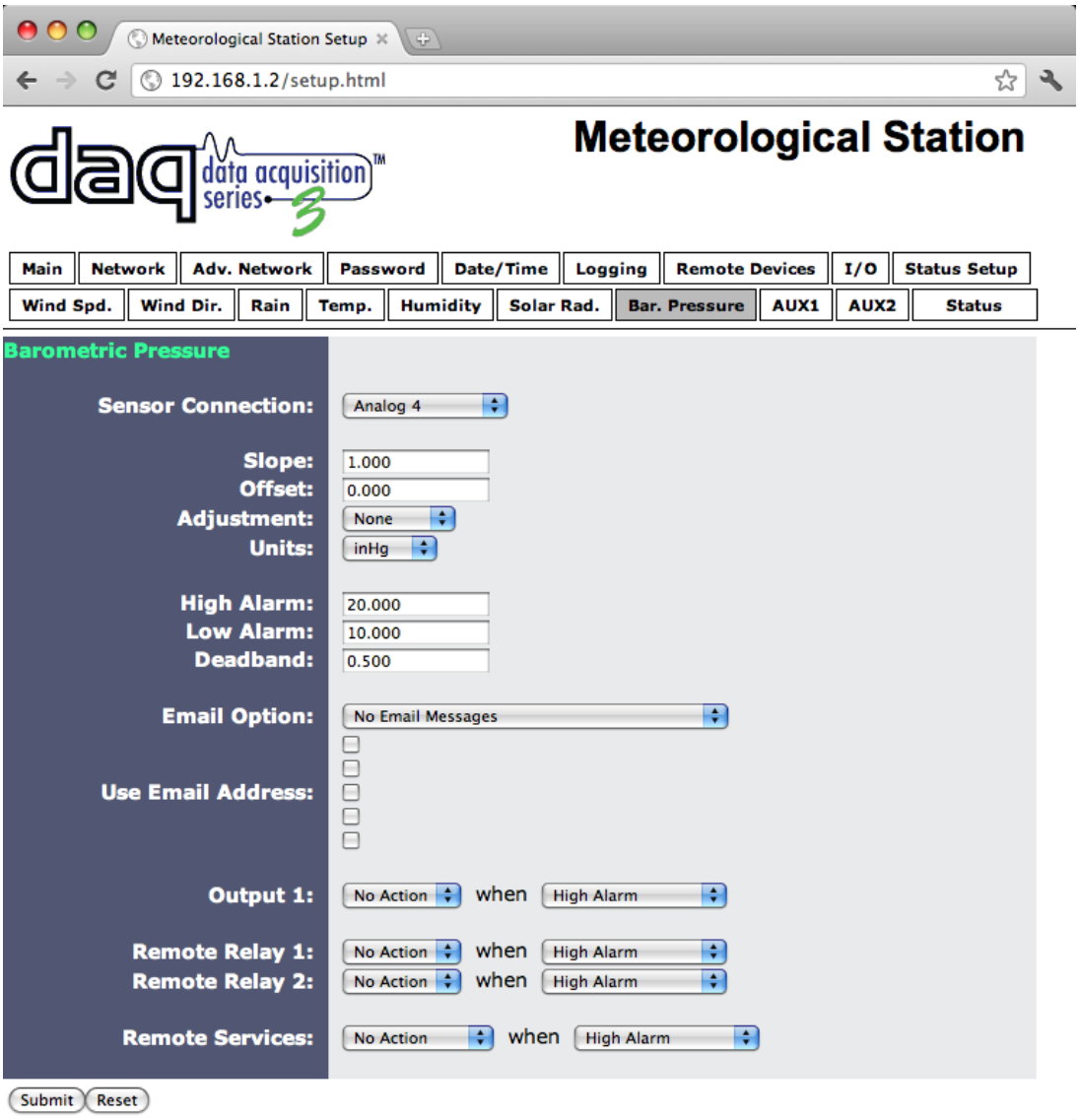


Figure 2.4v - Barometric Pressure Tab

Sensor Connection

This drop-down menu allows you to select which type of input you are using to monitor barometric pressure. The following typical sensor connections are available:

- ***None:*** This option is used if no sensor is connected to monitor barometric pressure.
- ***Rate 1-2:*** This option is used if the connected sensor outputs a pulse based on the barometric pressure.

Note: Input 1 or 2 must be configured as a counter when using rate.

- ***Analog 1-4:*** This option is used if the connected sensor outputs an analog signal based on the barometric pressure.
- ***Frequency Input:*** This option is used if the connected sensor outputs a frequency based on the barometric pressure.
- ***Rmt Analog 1-4:*** This option is used if the connected sensor is an analog sensor that is being read from a remote Analog device, such as another X-320™ or Analog Module.

Slope

In many cases, the inputs must be scaled to represent "real-world" measurements. X-320M™ reads the "raw" value from each input, and calculates the number that represents the "real-world" measurement that the user is actually interested in. This real-world value (referred to as the "Scaled Value" in this manual) is calculated using the following linear formula:

*Scaled Value = Slope * Input + Offset*

The Scaled Value is displayed on the **Status Page.** It is also used to determine alarm conditions, and is shown in email messages.

"Slope" in the formula above is provided by the user and is entered in this field. The value is used to scale the input to the range of detected condition.

The default value for this field is `1`.

When the Slope is set to 1 and Offset is 0 (default values), the Scaled Value equals the Input Value.

Offset

The "Offset" is used for the "zero" measurement. The default value for this field is `0`. When both the slope and offset are set to their default values, the Scaled Value equals the Raw Input.

Adjustment:

Depending on the type of sensor and/or the type of barometric pressure reading, the sensor reading may need to be adjusted so that sea level pressure is the indicated value. The default value for this field is `None`.

This drop-down allows you to select the adjustment used for the barometric pressure sensor. The following options are available:

- ***None:*** No adjustment will be applied to the input value from the sensor
- ***Sea Level:*** The input value from the sensor will be adjusted to indicate sea level pressure

Units

This drop down allows you to specify the units for the barometric pressure sensor. The units selected will be determined by the Slope and Offset used to calibrate the sensor. The following options are available:

- ***inHg:*** This option is used if you are measuring the barometric pressure in inches of Mercury.
- ***mmHg:*** This option is used if you are measuring the barometric pressure in milometers of Mecury.
- ***hPa:*** This option is used if you are measuring the barometric pressure in hectopascals.
- ***mbar:*** This option is used if you are measuring the barometric pressure in millibars.

High Alarm

This setting is used to set the trigger point for a high alarm condition. The alarm is triggered when the value at the sensor exceeds the High Alarm Value. The default High Alarm is `20`.

Low Alarm

This setting is used to set the trigger point for a low alarm condition. The alarm is triggered when the value at the sensor drops below the Low Alarm Value. The default Low Alarm is `10`.

Deadband

The Deadband prevents alarms from triggering excessively when the sensor measurement vacillates around the trigger point.

With High Alarms, the measurement must fall below the High Alarm point minus the Deadband before the High Alarm will be triggered again. Likewise, the Deadband on the Low Alarm requires the measurement to rise above the Low Alarm point plus the deadband before the Low Alarm will be triggered again.

For example, if the Deadband is set to .5 inHg, and a High Alarm occurs at 31 inHg, the alarm will not trigger again until the barometric pressure first drops below 30.5 inHg (31 - 0.5 inHg), as shown in the figure below. The default Deadband is _____. This can be set from _____ to _____.

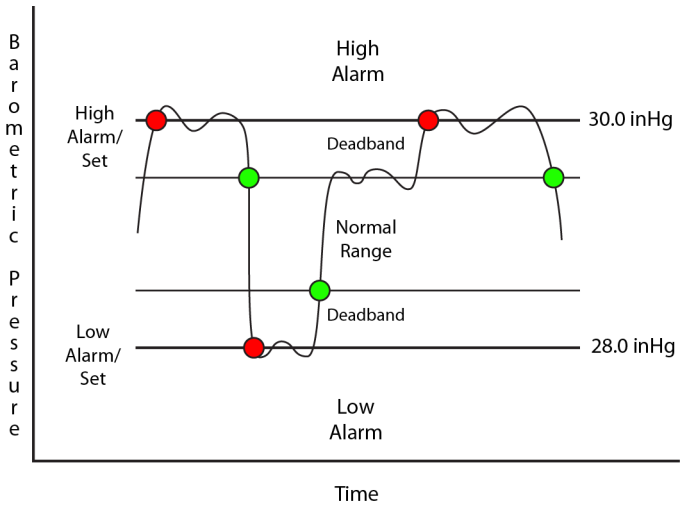


Figure 2.4w - Barometric Pressure Alarm Deadband

Email Option

Simple email messages can be sent in response to alarm conditions. This parameter is used to specify what alarm conditions, if any, will cause email messages to be sent. Email notification will work only if email is correctly set up in the **Network** setup page.

- ***No Email Messages****:* No email messages will be sent due to alarm conditions.
- ***Send Email on High Alarm***: Email notifications will be sent due to the High Alarm condition.
- ***Send Email on Low Alarm*****:** Email notifications will be sent due to the Low Alarm condition.
- ***Send Email on High and Low Alarm*****:** Email notifications will be sent due to the High and/or Low Alarm condition.
- ***Send Email on High, Low, and Normal*****:** Email notifications will be sent due to the High Alarm, Low Alarm, or when Normal conditions are regained.

Use Email Address

If email messages are to be sent based on alarm conditions, these check boxes specify to which email addresses the message will be sent. Email addresses specified on the **Network** setup tab will be shown next to each check box.

Output 1 or Output 2 (This option will only appear if one of the Digital I/O's is selected as an output on the I/O tab)

This field is used to set the action that the corresponding Output will have due to an alarm condition. The first drop down box specifies the action. The following actions are available:

- ***No Action:*** No action is taken by the output.
- ***Turn On:*** Turns the output On due to an alarm condition. The output will turn Off when alarm conditions are no longer met

The second drop-down box specifies the conditions that will cause the action previously specified. The following conditions are available:

- ***High Alarm:*** The specified output action occurs due to the High Alarm.
- ***Low Alarm:*** The specified output action occurs due to the Low Alarm.
- ***High or Low Alarm:*** The specified output action occurs due to the High and/or Low Alarm.

Remote Relay 1-2

X-320M™ can be configured to control relays in other ControlByWeb™ products that are located at a remote location on the network. This field determines the action taken by Remote Relay due to an alarm condition. The following actions are available:

- ***No Action:*** No action is taken by the relay.
- ***Turn On:*** Turns the relay On due to an alarm condition. The relay will turn off when alarm conditions are no longer met.

The second drop-down box specifies the conditions that will causes the action previously specified. The following conditions are available:

- ***High Alarm:*** The specified relay action occurs due to the High Alarm.
- ***Low Alarm:*** The specified relay action occurs due to the Low Alarm.
- ***High or Low Alarm:*** The specified relay action occurs due to the High and/or Low Alarm.

Remote Services

This field specifies the action with a remote server due to an alarm condition. The following actions are available:

- ***No Action***: No action is taken.
- ***Send Message***: state.xml will be sent to the remote server.

The second drop-down box specifies the conditions that will cause an alarm trigger. The following conditions are available:

- ***High Alarm***: The specified action occurs due to the High Alarm.
- ***Low Alarm***: The specified action occurs due to the Low Alarm.
- ***High or Low Alarm****: T*he specified action occurs due to the High and/or Low Alarm.

2.4.17 AUX1 and AUX2 Tab

The AUX1 and AUX2 setup pages allow you to configure additional sensors that are not listed under the default setup tabs.

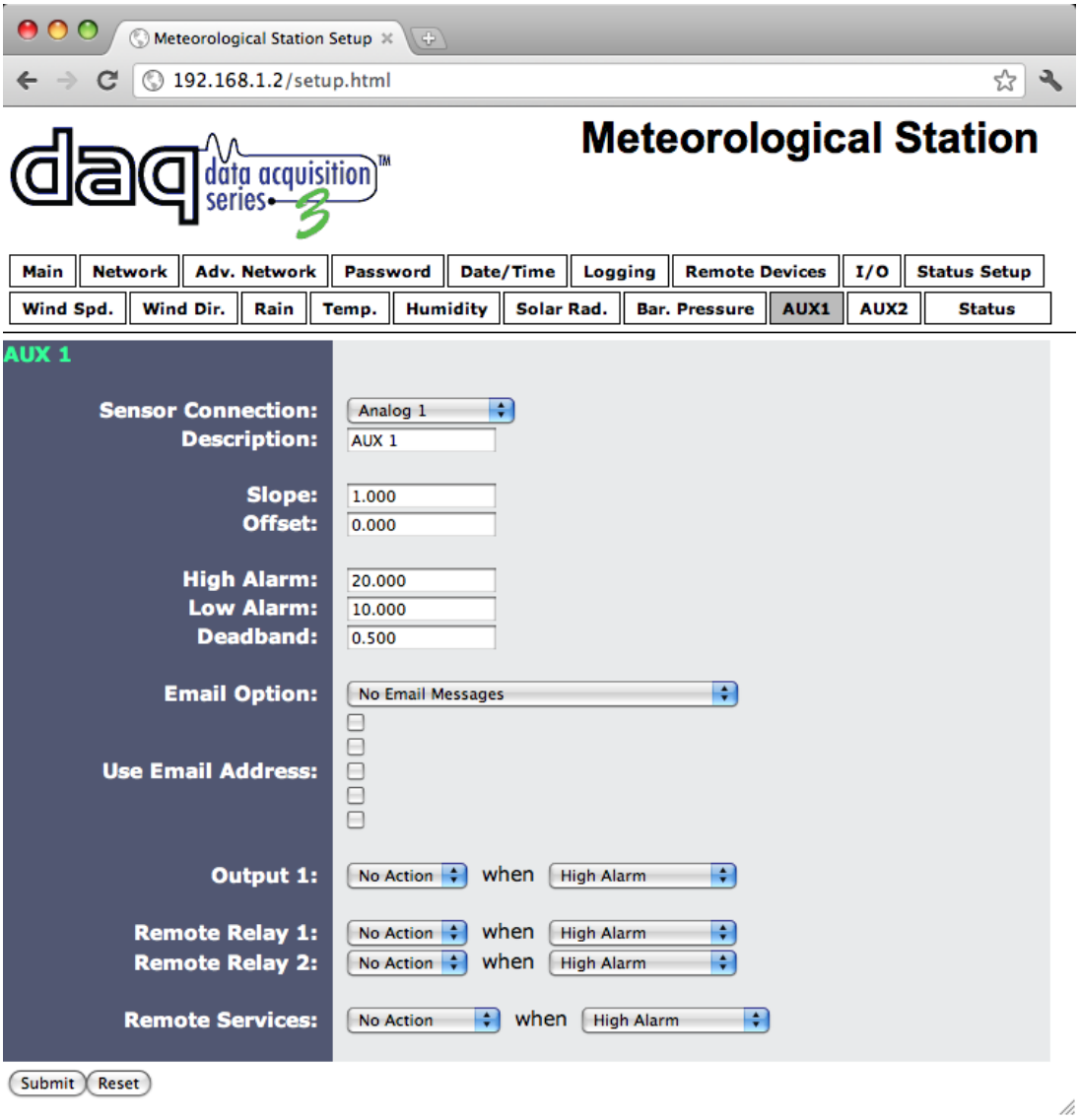


Figure 2.4x - AUX 1 and 2 Tab

Sensor Connection

This drop-down menu allows you to select which type of AUX input you are using. The following options are available:

- ***None:*** This option is used if no sensor is being used for AUX 1 or AUX 2.
- ***Rate 1-2:*** This option is used if the AUX1 or AUX2 sensor is set up as a rate counter. *Note: Input 1 or Input 2 must be setup as a counter when using this option.*

- ***Analog 1-4:*** This option is used if the AUX1 or AUX2 sensor outputs an analog signal.
- ***Frequency Input:*** This option is used if the AUX1 or AUX2 sensor outputs a frequency.
- ***1-Wire Bus:*** This option is used if the AUX1 or AUX2 sensor uses the 1-Wire Bus protocol.
- ***Rmt Analog 1-4:*** his option is used if the AUX1 or AUX2 sensor used is an analog sensor that is being read from a remote Analog device, such as another X-320™ or Analog Module.

1-Wire Address (only shown if 1-Wire Bus is selected in Sensor Connection)

Each 1-Wire sensor comes from the factory with a unique, non-changeable address. When the AUX tab is selected, X-320M™ scans the bus for sensors. The addresses of the sensors that are found on the bus are listed in the drop-down list.

Once a sensor is found on the bus, select the appropriate sensor address from the drop-down list to use that sensor for the 1-Wire sensor measurement.

Description:

This field is used to describe the sensor connected. It can be a maximum of ten characters long. The default description is `AUX1` or `AUX2`.

Slope

In many cases, the inputs must be scaled to represent “real-world” measurements. X-320M™ reads the “raw” value from each input, and calculates the number that represents the “real-world” measurement that the user is actually interested in. This real-world value (referred to as the “Scaled Value” in this manual) is calculated using the following linear formula:

*Scaled Value = Slope * Input + Offset*

The Scaled Value is displayed on the **Status Page.** It is also used to determine alarm conditions, and is shown in email messages.

“Slope” in the formula above is provided by the user and is entered in this field. The value is used to scale the input to the range of detected condition.

The default value for this field is `1`.

When the Slope is set to 1 and Offset is 0 (default values), the Scaled Value equals the Input Value.

Offset

The “Offset” is used for the “zero” measurement. The default value for this field is `0`. When both the slope and offset are set to their default values, the Scaled Value equals the Raw Input.

High Alarm

This setting is used to set the trigger point for a high alarm condition. The alarm is triggered when the value at the sensor exceeds the High Alarm Value. The default High Alarm is `20`.

Low Alarm

This setting is used to set the trigger point for a low alarm condition. The alarm is triggered when the value at the sensor drops below the Low Alarm Value. The default Low Alarm is `10`.

Deadband

The Deadband prevents alarms from triggering excessively when the sensor measurement vacillates around the trigger point.

With High Alarms, the measurement must fall below the High Alarm point minus the Deadband before the High Alarm will be triggered again. Likewise, the Deadband on the Low Alarm requires the measurement to rise above the Low Alarm point plus the deadband before the Low Alarm will be triggered again.

For example, if the deadband is set to 5, and a high alarm occurs at 50, the alarm will not trigger again until the value first drops below 45 (50 - 5), as shown in the figure below. The default Deadband is `0.50`.

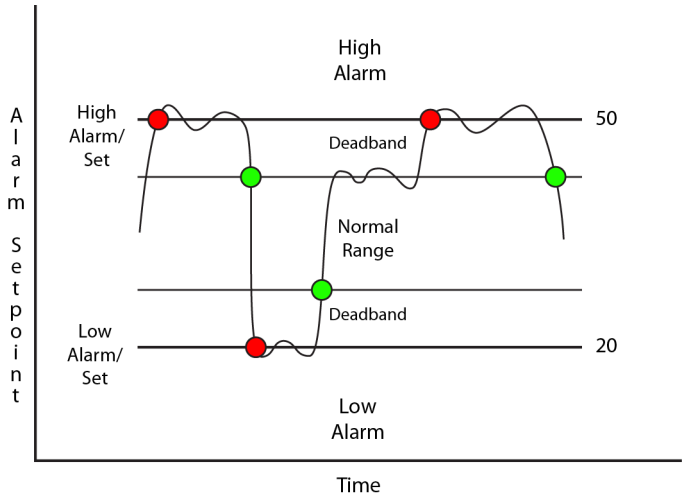


Figure 2.4y - AUX Alarm Deadband

Email Option

Simple email messages can be sent in response to alarm conditions. This parameter is used to specify what alarm conditions, if any, will cause email messages to be sent. Email notification will work only if email is correctly set up in the **Network** setup page.

- ***No Email Messages****:* No email messages will be sent due to alarm conditions.
- ***Send Email on High Alarm***: Email notifications will be sent due to the High Alarm condition.
- ***Send Email on Low Alarm*****:** Email notifications will be sent due to the Low Alarm condition.
- ***Send Email on High and Low Alarm*****:** Email notifications will be sent due to the High and/or Low Alarm condition.
- ***Send Email on High, Low, and Normal*****:** Email notifications will be sent due to the High Alarm, Low Alarm, or when Normal conditions are regained.

Use Email Address

If email messages are to be sent based on alarm conditions, these check boxes specify to which email addresses the message will be sent. Email addresses specified on the **Network** setup tab will be shown next to each check box.

Output 1 or Output 2 (This option will only appear if one of the Digital I/O's is selected as an output on the I/O tab)

This field is used to set the action that the corresponding Output will have due to an alarm condition. The first drop down box specifies the action. The following actions are available:

- ***No Action:*** No action is taken by the output.
- ***Turn On:*** Turns the output On due to an alarm condition. The output will turn Off when alarm conditions are no longer met

The second drop-down box specifies the conditions that will cause the action previously specified. The following conditions are available:

- ***High Alarm:*** The specified output action occurs due to the High Alarm.
- ***Low Alarm:*** The specified output action occurs due to the Low Alarm.
- ***High or Low Alarm:*** The specified output action occurs due to the High and/or Low Alarm.

Remote Relay 1-2

X-320M™ can be configured to control relays in other ControlByWeb™ products that are located at a remote location on the network. This field determines the action taken by Remote Relay due to an alarm condition. The following actions are available:

- ***No Action:*** No action is taken by the relay.
- ***Turn On:*** Turns the relay On due to an alarm condition. The relay will turn off when alarm conditions are no longer met.

The second drop-down box specifies the conditions that will causes the action previously specified. The following conditions are available:

- ***High Alarm:*** The specified relay action occurs due to the High Alarm.
- ***Low Alarm:*** The specified relay action occurs due to the Low Alarm.
- ***High or Low Alarm:*** The specified relay action occurs due to the High and/or Low Alarm.

Remote Services

This field specifies the action with a remote server due to an alarm condition. The following actions are available:

- ***No Action***: No action is taken.
- ***Send Message***: state.xml will be sent to the remote server.

The second drop-down box specifies the conditions that will cause an alarm trigger. The following conditions are available:

- ***High Alarm***: The specified action occurs due to the High Alarm.
- ***Low Alarm***: The specified action occurs due to the Low Alarm.
- ***High or Low Alarm****: T*he specified action occurs due to the High and/or Low Alarm.

Section 3: Operation

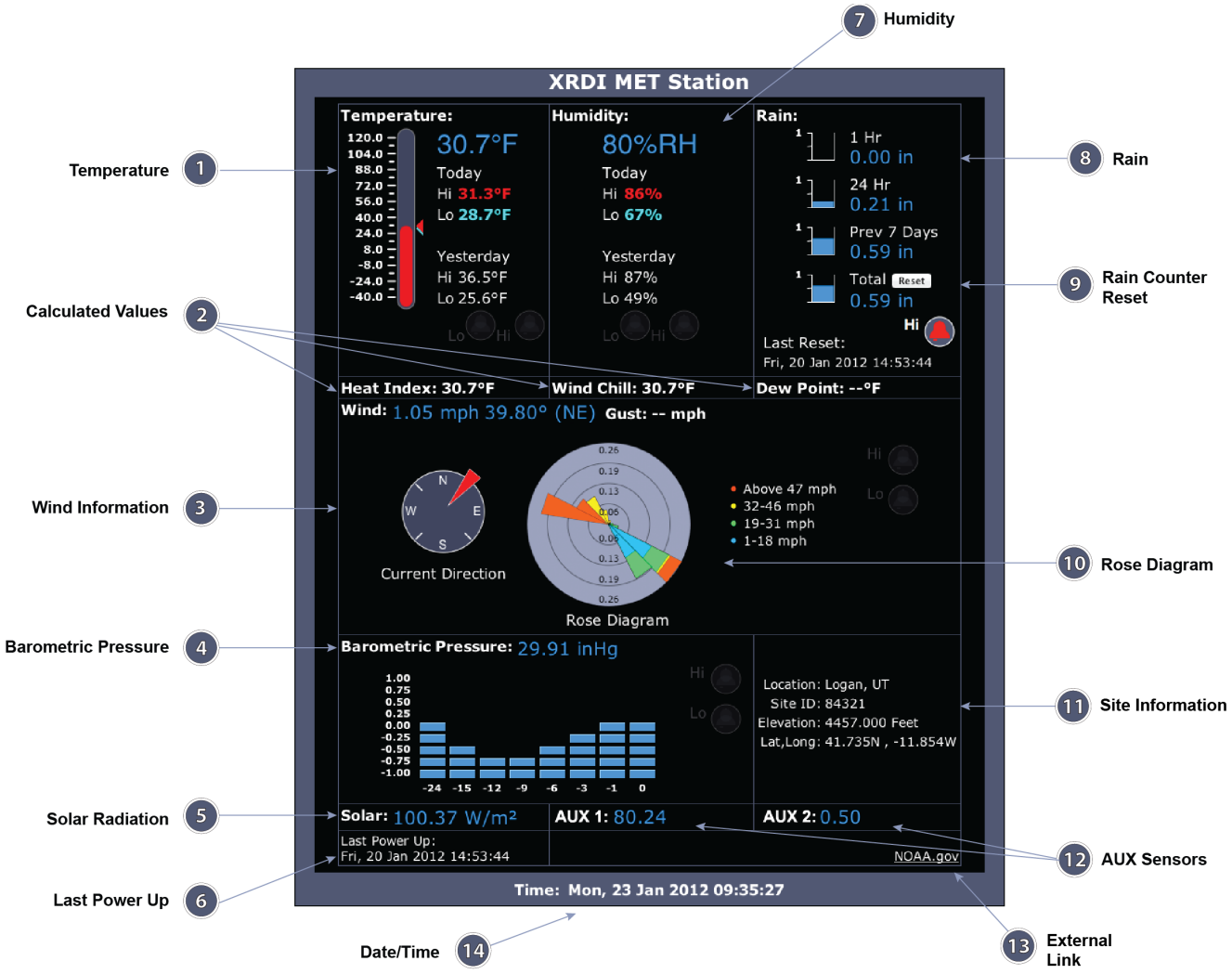
X-320M™ can be operated using a web browser, or by sending text commands to an XML status/control page. X-320M™ also allows you to control the outputs using inputs, or alarms.

Note: Using an input or alarm to control the outputs was described throughout previous sections of the manual, and will not be described here.

3.1 Browser Operation

Once X-320M™ is set up, users can access the **Status Page** using a web browser by typing the IP address of X-320M™ into the web browser address bar. For example, using the default IP address, the user would enter `http://192.168.1.2`. If the IP address is changed from the default, the user must use the new IP address. Note that if any port is used other than the default port 80, the port must also be included in the request. For example, accessing the unit at port 8000 would be as follows: `http://192.168.1.2:8000`.

The following screen appears when the **Status Page** is selected:



1 ***Temperature***
Display of the current temperature, current High and Low temperature values for today, and these values for yesterday. High/Low Alarm status.

2 ***Calculated Values***
This row displays the calculated values for the Heat Index, Wind Chill and Dew Point based off current wind and temperatures.

3 ***Wind Information***
Display of the current wind speed, direction, wind gust information, and High/Low Alarm status. When the wind is 10 knots above the low for the average period, then it is considered a gust and will be reported.

4 ***Barometric Pressure***
Display of the current barometric pressure reading, pressure-trend graph for previous 24 hours, and High/Low Alarm status.
Note: The historical information is retained by the web browser and is lost when the browser is closed. When the browser is opened, the table will be empty.

5 ***Solar Radiation***
Display of the current measurement from the Solar Radiation sensor.

6 **Last Power Up**
This displays the last time that X-320M™ was powered on. This information can be useful if the user wants to know whether or not the unit lost power during the time since the page was last viewed.

7 ***Humidity***
Display of the current humidity measurement, current High and Low humidity values for today, and these values for yesterday. High/Low Alarm status.

8 ***Rain***
Displays the rain accumulation data for the past hour, 24-hours, Previous 7 days, and a total accumulation. Total values are updated instantly. Hourly and 24-hour measurements are updated every 4 minutes, and the previous 7 days measurements are updated daily.

9 ***Rain Counter Reset***
This button resets the counters, as well as all rain totals back to zero.

10 ***Rose Diagram***
Displays a graphical representation of the current and historical wind patterns (up to 1 hour). The diagram is graduated with equally spaced radial rings representing a fraction of the Rose Diagram History period. The default period is 30 minutes.
Note: The historical information is retained by the web browser and is lost when the browser is closed. When the browser is opened, it will always show the current wind direction and the outermost ring will be labeled as 1.00.

11 ***Site Information***
Displays detailed information about the meteorological site.

12 ***AUX Sensors***
Displays the current values measured by any auxiliary sensors.

13 ***External Link***
Displays a link provided by the user to an external site or webpage. Configurable in the **Status Setup** tab.

14 ***Date/Time***
Displays the current time that is set using the **Date/Time** tab in the setup pages.

Note: Information about how these values are measured and calculated can be found in ***Appendix F: Methods and Calculation Details.***

3.2 XML Operation

Custom XML computer applications may be created to monitor and control X-320M™. This method does not use a web browser. There are three XML pages that can be used to monitor or control X-320M™: state.xml, eventX.xml. and Diagnostics.xml.

Refer to **Appendix D: External Server and Remote Services** for more information on network configurations when using XML.

3.2.1 State.XML

XML Monitor All Functions

The state of the I/Os, Counters, Rate, Frequency Input, Analog Input, and Sensors can be monitored by sending a request to port 80 (or port specified in setup). This can be demonstrated by entering the following URL into the address bar of a web browser (substituting the IP address as necessary):

```
http://192.168.1.2/state.xml
```

The following state.xml page is returned:

```
<datavalues>
      <windSpd>15.67</windSpd>
      <windDir>327.29</windDir>
      <rainTot>0.36</rainTot>
      <temp>29.13</temp>
      <humidity>34.51</humidity>
      <solarRad>426.48</solarRad>
      <barPressure>30.11</barPressure>
      <aux1>79.36</aux>
      <aux2>--</aux>
      <rain1h>0.00</rain1h>
      <rain24h>0.00</rain24h>
      <rain7d>0.36</rain7d>
      <rain30d>0.36</rain30d>
      <rainAlrm>0</rainAlrm>
      <tempH>29.38</tempH>
      <tempL>23.63</tempL>
      <tempHY>27.51</tempHY>
      <tempLY>25.07</tempLY>
      <heatIndex>28.28</heatIndex>
      <windChill>--</windChill>
      <dewPoint>11.87</dewPoint>
      <tempAlrm>2</tempAlrm>
      <humidityH>43.73</humidityH>
      <humidityL>34.40</humidityL>
      <humidityHY>43.49</humidityHY>
      <humidityLY>36.98</humidityLY>
      <humidityAlrm>1</humidityAlrm>
      <presN1>30.13</presN1>
      <presN3>30.16</presN3>
      <presN6>30.18</presN6>
      <presN9>30.16</presN9>
      <presN12>30.15</presN12>
      <presN15>30.13</presN15>
```

```
        <presN24>30.14</presN24>
        <presAlrm>1</presAlrm>
        <windGust>47.00</windGust>
        <windAlrm>2</windAlrm>
        <serialNumber>00:0C:C8:00:00:09</serialNumber>
        <time>1309963843</time>
</datavalues>
```

The numbers enclosed by the tags, <tag>, indicate the current state or value monitored by X-320M™. Values for each tag are described in the table below.

XML computer applications will open a TCP/IP socket with X-320M™ and send a GET command followed by the state.xml command string. (See **Section 3.3** for instructions on using GET.)

XML Tags	Monitor Values
<windSpd>	Indicates the current wind speed.
<windDir>	Indicates the current wind direction.
<rainTot>	Indicates the current rainfall total.
<temp>	Indicates the current temperature measurement. -- = Indicates that no digital temperature sensor is attached. 77.3 = Current temperature.
<humidity>	Indicates the current relative humidity measurement -- = Indicates that no digital humidity sensor is attached. H24.9 = Current humidity reading.
<solarRad>	Indicates the current solar radiation value.
<barPressure>	Indicates the current barometric pressure.
<aux1>	Indicates the current value measured by an auxiliary sensor 1.
<aux2>	Indicates the current value measured by an auxiliary sensor 2.
<rain1h>	Indicates the total rainfall for the past 1 hour.
<rain24h>	Indicates the total rainfall for the past 24 hours.
<rain30d>	Indicates the total rainfall for the past month.
<rainAlrm>	Current state of the sensor alarms. 0 = Normal 1 = High Alarm
<tempH>	Indicates today's current high temperature.
<tempL>	Indicates today's current low temperature.
<tempHY>	Indicates yesterday's high temperature.
<tempLY>	Indicates yesterday's low temperature.
<heatIndex>	Indicates the calculated heat index value.

XML Tags	Monitor Values
<windChill>	Indicates the calculated wind chill value.
<dewPoint>	Indicates the calculated dew point.
<tempAlrm>	Current state of the temperature alarm. 0 = Normal 1 = High 2 = Low
<humidityH>	Indicates today's highest humidity reading.
<humidityL>	Indicates today's lowest humidity reading.
<humidityHY>	Indicates yesterday's highest humidity reading.
<humidityLY>	Indicates yesterday's lowest humidity reading.
<humidityAlrm>	Current state of the humidity alarm. 0 = Normal 1 = High 2 = Low
<presN1>	Indicates the measured barometric pressure last hour.
<presN3>	Indicates the measured barometric pressure three hours prior.
<presN6>	Indicates the measured barometric pressure six hours prior.
<presN9>	Indicates the measured barometric pressure nine hours prior.
<presN12>	Indicates the measured barometric pressure twelve hours prior.
<presN15>	Indicates the measured barometric pressure fifteen hours prior.
<presN24>	Indicates the measured barometric pressure twenty-four hours prior.
<presAlrm>	Current state of the barometric pressure alarm. 0 = Normal 1 = High 2 = Low
<windGust>	Indicates the wind gust measurement during the last average period.
<windAlrm>	Current state of the wind speed alarm. 0 = Normal 1 = High 2 = Low
<serialNumber>	00:00:00:00:00:00, serial number of X-320M™.
<time>	Time displayed in “epoch time” (number of seconds since January 1, 1970).

XML Control

Commands can be sent to X-320M™ to control the outputs, counters, and external variables.

Output State Control

Commands are sent using a variable called relayXState (X is replaced by 1 for Output 1, or 2 for Output 2).

A few examples of using relayXState are given below.

Command	Description
`state.xml?relay1State=0`	Turn Output 1 *OFF*
`state.xml?relay1State=1`	Turn Output 1 *ON*
`state.xml?relay2State=0`	Turn Output 2 *OFF*
`state.xml?relay2State=1`	Turn Output 2 *ON*

Pulse Relay

When the pulse command is sent, the output will turn ***ON*** for the Pulse Duration specified in the **Digital I/O** setup page . It is also possible to send a pulse time command that is different than the configured Pulse Duration. This is done by sending a pulseTime variable.

The pulseTime variable does not change the Pulse Duration in the setup page and it is not stored or recorded. The pulseTime variable only changes the duration for the single pulse initiated by that command. In other words, you must issue the pulseTime command for each pulse command that differs from the preset value.

For example, say X-320M™ is configured for a Pulse Duration of 1.5 seconds. To send one 1.5-second pulse, three 5-second pulses, and another 1.5-second pulse to Output 1, you would issue the following commands.

Command	Description
`state.xml?relay1State=2`	Pulse Output 1 for the preset time (1.5 seconds).
`state.xml?relay1State=2&pulseTime1=5`	Pulse Output 1 for 5 seconds.
`state.xml?relay1State=2&pulseTime1=5`	Pulse Output 1 for 5 seconds.
`state.xml?relay1State=2&pulseTime1=5`	Pulse Output 1 for 5 seconds.
`state.xml?relay1State=2`	Pulse Output 1 for the preset time (1.5 seconds).

Message Acknowledgment

By default, when commands are sent to X-320M™, the state.xml page is returned. The XML reply can be disabled by adding the `noReply` field as follows:

Command	Description
`state.xml?relay1State=1&noReply=1`	Turn Output 1 *ON* without returning state.
`state.xml?relay1State=0&noReply=1`	Turn Output 1 *OFF* without returning state.

3.2.2 Diagnostics.XML

There is a special diagnostics.xml that can be requested by entering the following in the web browser address bar:

```
http://192.168.1.2/diagnostics.xml
```

The following diagnostics.xml file is returned:

```
<datavalues>
      <internalTemp>43.5</internalTemp>
      <vin>16.5</vin>
      <internal6Volt>6.2</internal6Volt>
      <memoryPowerUpFlag>1</memoryPowerUpFlag>
      <devicePowerUpFlag>1</devicePowerUpFlag>
      <powerLossCounter>3</powerLossCounter>
</datavalues>
```

Diagnostic tags are given in the table below.

Tag	Description
<internalTemp>	Indicates the internal temperature of the device.
<vin>	Indicates the DC voltage that is applied to the Vin+ and Vin- terminals.
<internal6Volt>	Indicates the DC voltage of the internal 6V power supply.
<memoryPowerUpFlag>	Indicates a loss of power to the capacitor-backed real-time clock. A value of 1 indicates that the real-time clock lost power. This should only happen if the device has lost power for several days. There is an internal capacitor that can power the real-time clock for an extended period of time, even if the main power is lost. If the real-time-clock loses power, the time will have to be reset. By default, this will read 1 until it is set to 0.
<devicePowerUpFlag>	Indicates a loss of power to the device. This field can also be set to 0. A value of 1 means X-320M™ has lost power at least one time since the flag was set to 0.
<powerLossCounter>	This field is a count of how many times X-320M™ has lost main power.

The above flags may be cleared by requesting the diagnostics.xml file along with request parameters.

To clear the real-time clock power-loss flag:

```
http://192.168.1.2/diagnostics.xml?memoryPowerUpFlag=0
```

To clear the device power-loss flag:

```
http://192.168.1.2/diagnostics.xml?devicePowerUpFlag=0
```

To clear the powerLossCounter flag:

```
http://192.168.1.2/diagnostics.xml?powerLossCounter=0
```

Resetting of multiple flags may be done at one time by placing & between each request:

```
http://192.168.1.2/diagnostics.xml?memoryPowerUpFlag=0&devicePowerUpFlag=0
```

Note: Requests for the diagnostics.xml file do not require a password.

3.3 GET Requests

3.3.1 Using GET for Control and Monitoring

No Password

GET requests to the device for XML files.

Example request about.html:

```
GET /about.html HTTP/1.1\r\n\r\n
```

Example turn Output 1 On:

```
GET /state.xml?relay1State=1\r\n\r\n
```

Password Enabled

If the Control Password is enabled on X-320M™ and the state.xml page is requested through a browser, the user will be prompted for a password. If the XML request is sent from an XML application, the html request will need to contain the password, encoded as Base64.

The following is an html request header without the password:

```
GET /state.xml?relay1State=1&noReply=1 HTTP/1.1 (Terminated with two \r\n.)
```

The following example adds the password:

```
GET /state.xml?relay1State=1&noReply=1 HTTP/1.1 (Terminated with \r\n.)
Authorization: Basic bm9uZTp3ZWJyZWxheQ== (Terminated with two \r\n.)
```

`bm9uZTp3ZWJyZWxheQ==` is the Base64 encoded version of the user “name:password,” `none:webrelay.`

A utility is provided at http://www.controlbyweb.com/encoder to encode the password. Simply type the string username:password into the website and press 'Encode'.

3.4 Email Notification

3.4.1 Email Notification Description

X-320M™ can be configured to send messages to five email addresses when a sensors alarm point is reached. Sensors that are connected to X-320M™ and configured can generate an email message

When an email message is sent, it will look similar to this:

```
MET Station

Trigger: RAIN - High Alarm
WSPD: 15 mph
WDIR: 270 degrees
RAIN: 20 inches
TEMP: 78.57 °F
HDTY: 34 %RH
SRAD: 400 W/m²
PRESS: 29.97 inHg
AUX1:  0.00 units
AUX2:  0.00 units
```

Subject Line

The top line (that reads MET Station) appears in the subject line of the email message. This is the same text that appears as the header on the **Status Page**. It is set in the Site Description Text field under the **Status Setup** tab.

Trigger

The first line displayed in the body of the message shows the event that triggered the message. The text “Trigger” will always appear and cannot be changed. The remaining text includes the trigger name, and what caused the trigger. The text that describes the trigger and its current state are configured in the setup pages.

Current Status of the Meteorological Station

The remainder of the email message will display the same information shown on the **Status Page**. Sensors that are not used on the **Status Page** will not be included in the email message.

3.4.2 Email Notification Setup

Email notification requires that the following fields are properly configured. See **Section 2.4.2** for a description of each field.

Network Tab

IP Address
Subnet Mask
Gateway
Preferred DNS Server (this is required if Mail Server is entered by name and not by IP address)
Alt DNS Server
Mail Server (SMTP)

User Name (If Required)
Password (If Required)
Return Email
Email 1
Email 2
Email 3
Email 4
Email 5

*Note: X-320M™ must be power-cycled (power disconnected, then reconnected) before network settings take effect. Only the settings on the **Network** tab require power-cycling before taking effect.*

The email options and recipients for each monitored value can be configured separately. Select the Email Option and checkbox for the desired email recipient for each measured value.

Once the email settings are entered, the email functionality can be tested by entering the following command:

```
http://IP address/state.xml?testEmail=1
```

For example, using the default IP address, enter:

```
http://192.168.1.2/state.xml?testEmail=1
```

This will cause an email message to be sent immediately. If the messages don't get through, the system log file may have some clues to assist in diagnosing the problem (http://192.168.1.2/syslog.txt). See **Appendix E: Log Files** for additional Logging Information.

Appendix A: Restoring Factory Default Settings

In the event that the IP address or passwords are forgotten, X-320M™ may be restored to its original factory default settings.

1. Remove the DC power from the unit.
2. Use a thin, non-conductive object (such as a toothpick) to press and hold the small button located on the bottom of the unit. When the object is inserted, a tactile feedback can be felt as the button is depressed.

   CAUTION: DO NOT USE METAL OBJECTS FOR THIS FUNCTION.
3. While depressing the button, apply power and wait for about 10 seconds before releasing the button. All settings will be set back to the original factory defaults. log.txt and syslog.txt are retained.
4. Refer to **Section 2.3 Establishing Communications for Setup** to begin reconfiguration of the device.

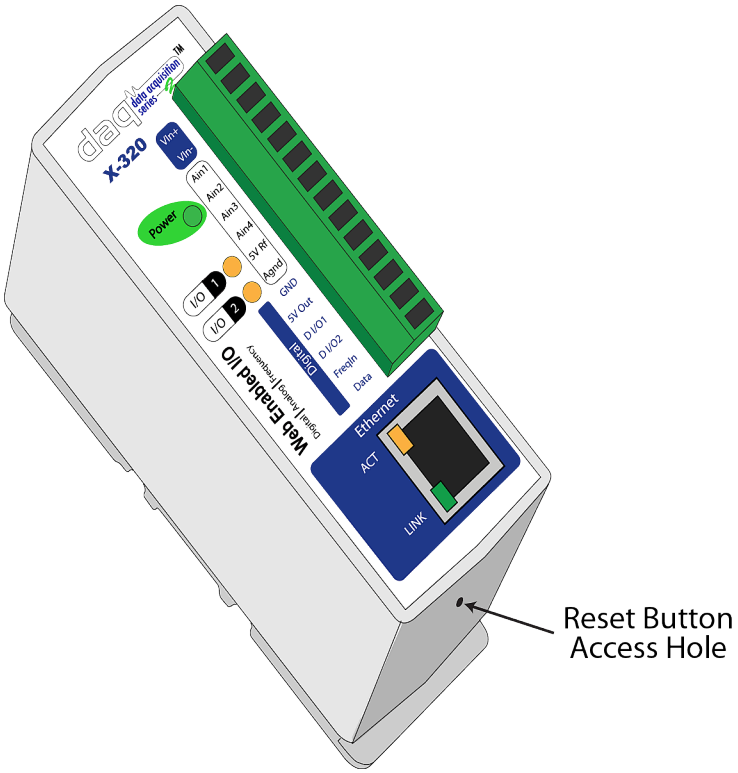


Figure Appendix A.1 - Restore Factory Defaults

Appendix B: Installing New Firmware

From time to time, updates are made to X-320M™ firmware. The firmware can be updated in the field. The procedure for updating the firmware is outlined below. Please note that it is important that this procedure is followed precisely.

Requirements

The firmware update software requires Windows XP/Vista/7 with the .Net framework installed. The .Net framework is generally installed automatically through Windows update. To install it manually, go to the following address:

http://www.microsoft.com/downloads/details.aspx?FamilyId=333325FD-AE52-4E35-B531-508D977D32A6&displaylang=en

Select the Download button. Once you've downloaded the installation file, double click on the installation file to install the framework.

Setup

1. Download the firmware zip file from the ControlByWeb website. Only a X-320M™ image can be installed on X-320M™ so make sure the correct image is being downloaded.
2. bootloader.exe will connect to X-320M™ using default IP address 192.168.1.2, not the address currently assigned to X-320M™. After the update, all settings will be lost and the device will return to its default IP address of 192.168.1.2.

   Configure the PC to the same subnet as the IP address 192.168.1.2, such as 192.168.1.10. For instructions on doing this, see section **2.3 Establishing Communications for Setup**.

   Note: The IP address of X-320M™ will automatically be set to the default 192.168.1.2 during the update process.

   Note: A crossover cable cannot be used during the update procedure; an ethernet switch will be necessary to properly update the firmware.

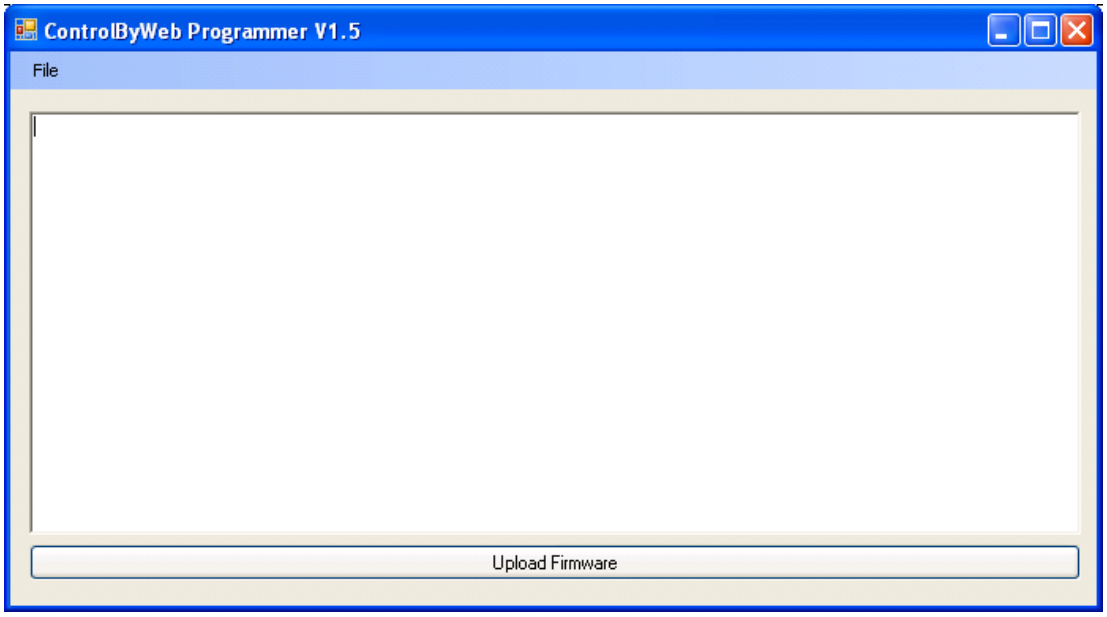


Figure Appendix B.1 - Firmware Update Utility

3. Open the bootloader.exe utility on the computer by double clicking on the downloaded file (Figure Appendix B.1).
4. Within the ControlByWeb™ Programmer utility programmer, select File, then Open. Specify the firmware image downloaded from the ControlByWeb™ web site.

Device Upgrade Procedure

Carefully follow the following steps to put X-320M™ into bootloader mode and perform the upgrade:

1. Remove DC power from X-320M™.
2. Using a small, non-conductive tool, press and hold the reset button.
3. While holding the reset button, apply power to X-320M™. The LINK and ACT lights will flash. Continue to hold the reset button for the next step.
4. While holding the reset button, press the Upload Firmware button at the bottom of the ControlByWeb™ Programmer window. After the programming process begins, the reset button can be released
5. Programming will take approximately 20-30 seconds. The LINK LED will stop flashing and remain lit during this time. X-320M™ will be set to factory defaults with an IP address of 192.168.1.2.
6. Refer to section **2.3 Establishing Communication for Setup** to reconfigure the X-320M™. Verify the new version of firmware has been installed by viewing the default **Setup Page** with a web browser (http://192.168.1.2/setup.html).

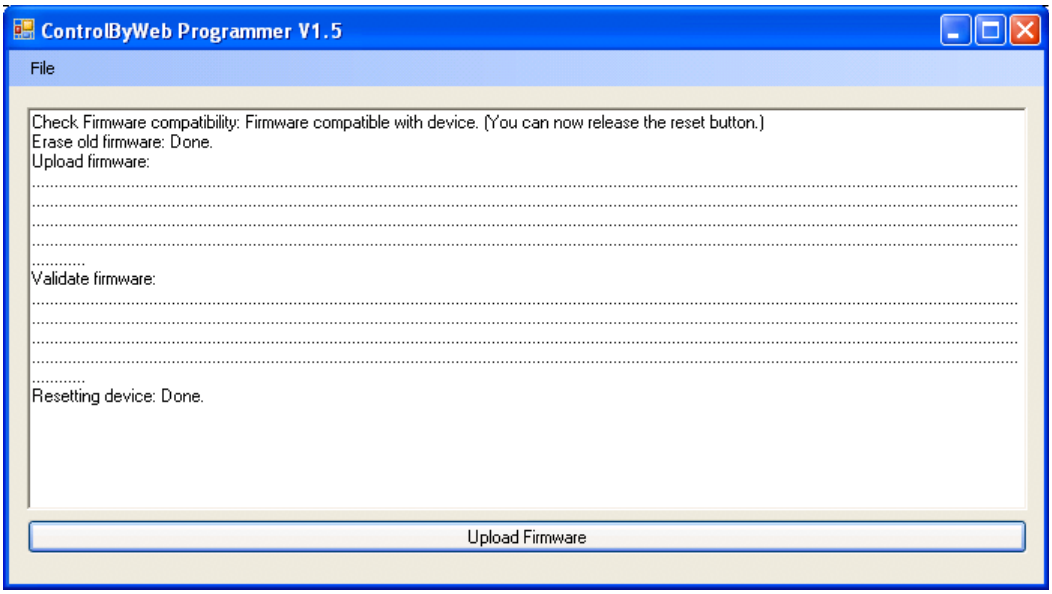


Figure Appendix B.2 - Firmware Update Complete

Appendix C: Accessing X-320™ Over the Internet

X-320M™ can be monitored and/or controlled from a remote location over the Internet. Once X-320M™ can be accessed on the local network, almost all of the settings required to provide remote access are in the router and not in X-320M™. This guide is not meant to be a tutorial in router setup, but rather to provide a basic overview of remote access. For specific details, the user should refer to the instruction manual for the router on the local network. Users not familiar with basic IP networking should study one or more basic IP networking tutorials before proceeding (many tutorials are available on the Internet).

IP Addresses

Every device on the Internet is identified by a unique address called an IP (Internet Protocol) address. IP addresses are somewhat similar to mailing addresses in that they identify the precise logical location of the device on the Internet. The IP address identifies the global region down to the network and then the specific device on that network. IP addresses are globally maintained and assigned by an entity called the Internet Assigned Numbers Authority (IANA). IP addresses consist of four sets of numbers that range from 0 to 255 and are separated by a decimal. For example, 192.168.200.167 is an IP address.

Every device that is “directly” connected to the Internet uses a “public” IP address. X-320M™ can be assigned a public IP address for direct connection to the Internet. Typically, a public IP address would only be assigned to X-320M™ when it is the only device on the local network. The IP address would be obtained from an Internet Service Provider (ISP).

Due to the limited number of public IP addresses, private networks can be set up with “private” IP addresses. These addresses are used within a local network and have no global designation; they are not routed on the Internet. The following address blocks are designated for private networks (where x represents decimal numbers from 0 to 255): 192.168.x.x, 10.x.x.x, and 172.16.x.x.

A Simple Local Area Network

A small Local Area Network (LAN), can be made up of two or more computers or other devices connected to an Ethernet switch. Each device on the network is assigned a unique private IP address. For example, consider a simple network that consists of a computer, an X-320M™, and a WebRelay™. In this example, the computer is assigned an IP address of 192.168.1.10, X-320M™ has the IP address of 192.168.1.25 and a WebRelay™ has and IP address of 192.168.1.26. A person using the computer can access X-320M™ by entering its IP address in the URL line in the browser, http://192.168.1.25. Similarly, WebRelay™ can be accessed by entering its unique private IP address in the URL line in the browser, http://192.168.1.26.

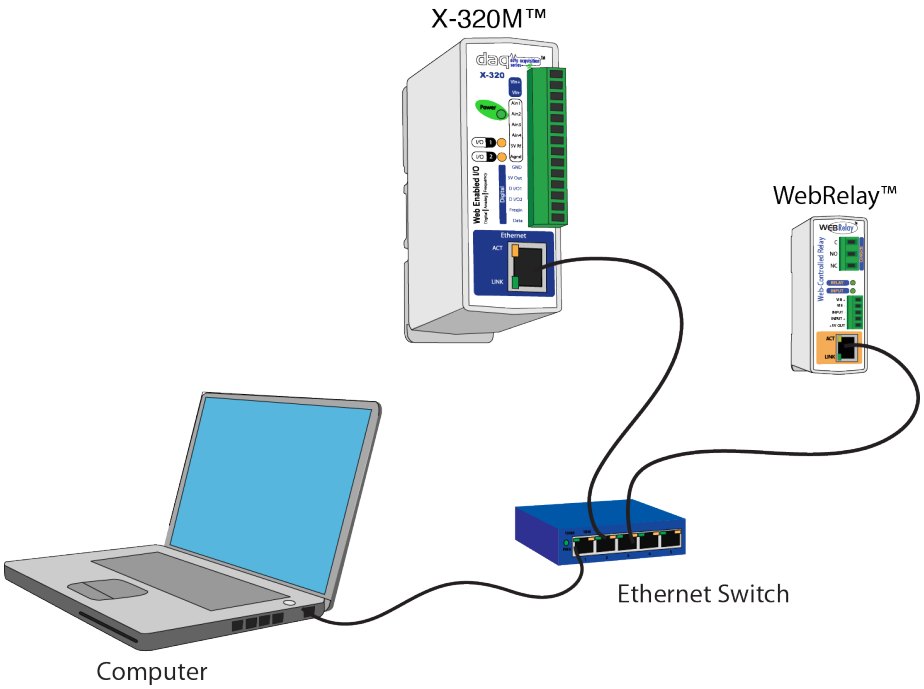


Figure Appendix C.1 - Local Area Network

A Simple LAN connected to the Internet

The LAN in the example above can be connected to the Internet by adding a router and an Internet connection. The router has two network connections: It has an Ethernet network connection to the LAN and another connection to the Internet. Often the Internet connection is called a Wide Area Network (WAN) connection. Each network connection on the router has an IP address. In our example, the IP address on the LAN side of the router has an address of 192.168.1.1. The IP address on the WAN side of the router has an IP address that has been assigned by the Internet Service Provider, such as 266.70.164.97. (This is not a valid IP address because each number cannot be larger than 255 It is used in this example for illustration purposes only.)

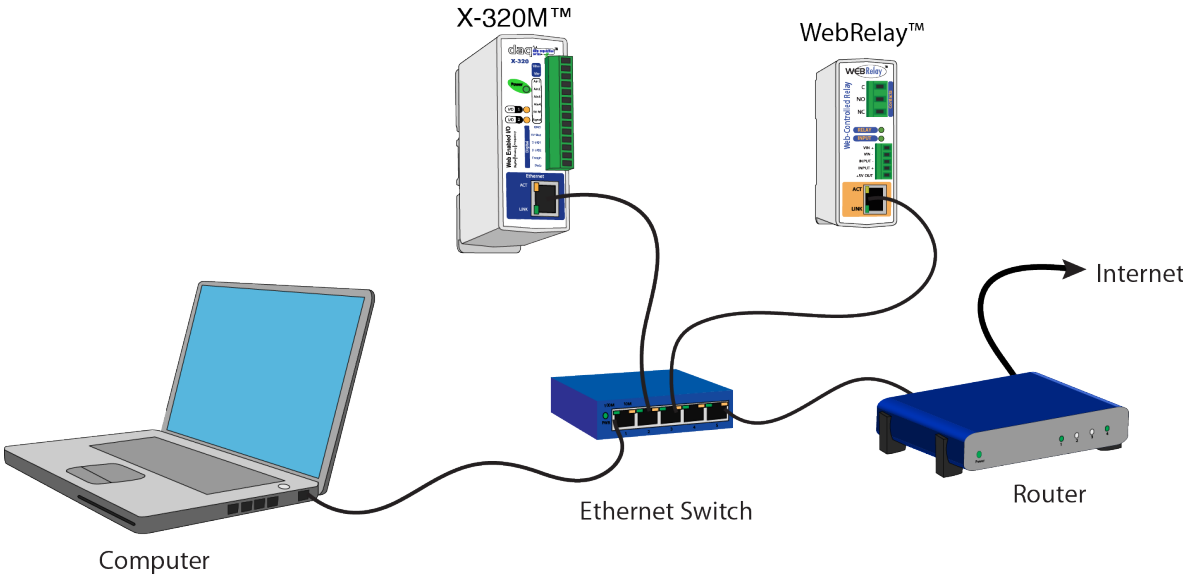


Figure Appendix C.2 - LAN Connected to the Internet

In the example, when a user on the computer needs to access a server on the Internet, the computer sends the request to the router at 192.168.1.1. The router sends the request to the ISP server on the Internet. The ISP server does not send the response directly to the computer on the LAN, but to the router at the IP address of 266.70.164.97. The router then forwards the response to the computer. This way, all devices on the LAN share a single public IP address. This is called Network Address Translation (NAT).

Port Forwarding

The router can be configured to allow outside access to X-320M™ and WebRelay™. All requests from the Internet to any device on the local network must use the public IP address (266.70.164.97). With only a single IP address, TCP ports are used to identify the intended device for the incoming message.

Using the mailing address analogy, the port is similar to a post office box. The IP address specifies the location, and the port specifies the specific recipient. Port numbers can be set to any number between 1 and 65235. However, many port numbers are reserved for specific applications and should be avoided. As a general rule, numbers above 8000 are safe to use. All of the ControlByWeb™ products come from the factory with the HTTP port set to 80, which is the standard port for HTTP. In this example, X-320M™ HTTP port will be changed to port 8000 and WebRelay™ port will be changed to 8001. Once the ports are changed in the two ControlByWeb™ devices, the router must be set up for port forwarding.

Port forwarding associates the IP address of each local device with an assigned port. In this example, the address 192.168.1.25 for X-320M™ would be associated with port 8000. The address 192.168.1.26 for WebRelay™ would be associated with port 8001. X-320M™ would be accessed from the Internet by entering the public IP address of the router, plus the port number assigned to X-320M™ in the URL window of the browser, http://266.70.164.97:8000. All Internet requests to the router for port 8000 would be forwarded to X-320M™. Similarly, all request for port 8001 would be forwarded to WebRelay.

Note: When an HTTP request comes in to the router without the specific port specified (http://266.70.164.97), the router will handle this as a port 80 request (default HTTP port). In other words, http://266.70.164.97 is exactly the same as http://266.70.164.97:80.

Router configuration can vary widely. Some routers have the capability of translating the addresses and the ports, which would require no port configuration change on the WebRelay. For example, the router would be configured so that messages sent to http://266.70.164.97:8000 would be forwarded to http://266.70.164.97:80, which is the default HTTP port.

An example screen shot of a router configuration is given below. This setup allows the two ControlByWeb™ products in the above example to be accessed remotely from the Internet.

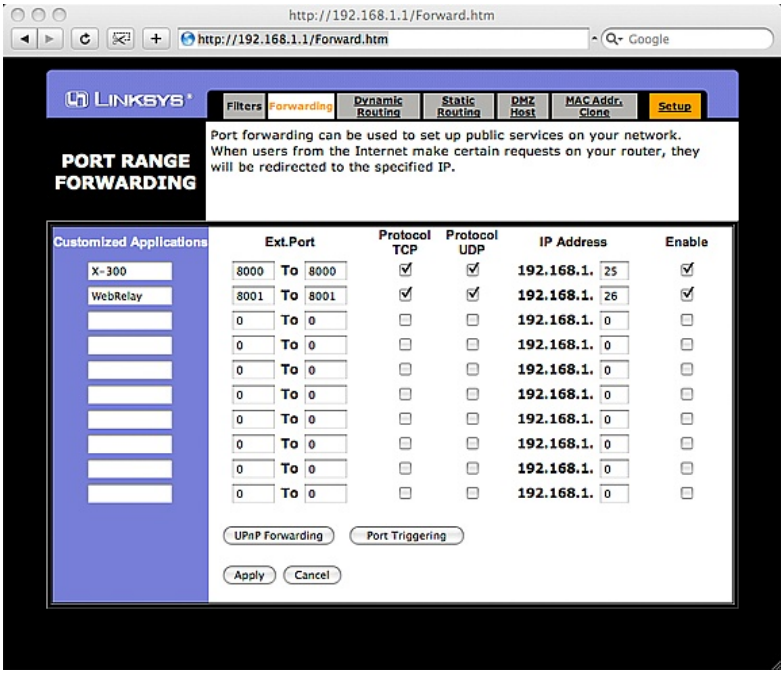


Figure Appendix C.3- Port Range Forwarding

Note: This screen shot is simply an example of a typical router setup page. Routers will vary.

Accessing Setup Pages

After changing ports, the setup pages are accessed on a local network as described below:

```
http://(Local IP Address):(Port Number)/setup.html
```

For example, to access the setup pages when the port is set to 8000, the following command would be used:

```
http://192.168.1.25:8000/setup.html
```

To access the ControlByWeb™ units from the Internet, enter the public IP address of the router plus the port number of the desired device in the following format:

```
http://(Public IP Address of Router):(Port Number of Device)/setup.html
```

Using the example above, the following line would be used to access the setup page of X-320M™:

```
http://266.70.164.97:8000/setup.html
```

Appendix D: External Server and Remote Services

Note: The following methods are supported by X-320M™; however, Xytronix Research & Design, Inc. does not provide or support custom third party applications or external web servers.

Accessing X-320M™ with Custom Software or Third Party Applications

Custom applications can send commands to X-320M™ for monitoring and control functions using XML. (See **3.2 XML Operation** for more information.) The application interface can be used to provide a custom user interface, access to multiple units in a single screen, and allow for automation, logging, and other application-specific features.

Using an External Web Server

Rather than accessing X-320M™ directly from a computer, an external web server can be used. The term “external” web server is used here to mean a separate web server (such as Apache or IIS) that is not the web server built into X-320M™. In this scenario, users access custom web pages that reside on the external web server and the external web server communicates with X-320M™.

An external web server can integrate multiple ControlByWeb products into a single control page. In other words, the user may not be aware that he/she is using multiple ControlByWeb™ devices, but rather the user sees an integrated control page for the entire system. In addition, the use of an external web server allows programmers to create custom user interfaces that take advantage of the additional resources typically available on larger web servers, including more memory and various web programming languages.

There are two approaches that an external server can use to communicate with X-320M™ and other ControlByWeb™ devices: Direct Server Control and Remote Services.

Direct Server Control

The first approach is for the external server to create a TCP connection whenever it needs to access X-320M™. In this case, the external server opens the connection, sends commands and/or reads the device, and closes the connection.

This method is ideal when the the web server and all of X-320M™ devices are on the same network (without routers between them). In this case, the server can communicate with X-320M™ devices directly and securely since data never has to leave the local network.

When the server and X-320M™ are on different networks, routers must be configured to allow appropriate access. If a public network is used, such as the Internet, security precautions should be considered.

Remote Services

The second approach is for X-320M™ to initiate a connection using the “Remote Services.” The settings under the **Advanced Network** tab in the setup pages will enable the X-320™ to open a TCP connection with an external server. Once the connection is open, the external server can send commands and/or read the device. The external server can leave the connection open (so that it never closes) or close the connection.

“Remote Services” is ideal for installations where the server and X-320M™ are installed on different networks. This is especially useful when each X-320M™ is installed on a separate private network. For example, if the user doesn't control the network connections where X-320M™ is installed, “Remote Services” would initiate a TCP connection over the Internet with the control computer. Since X-320M™ initiates the connection, the control computer doesn't have to know the IP address of X-320M™. This means that X-320M™ can be installed using DHCP. In addition, no special router configuration is

required. This makes the network installation of X-320M™ very simple, and since no incoming ports need to be opened in the router, security is not compromised. See section **2.4.3 Advanced Network Tab** for more information.

X-320M™ can be configured to establish a connection when triggered by an event, such as a I/O state changing. This is done by setting the Remote Service/SNMP checkbox in the **I/O** setup tabs.

When an event occurs and a connection is open, the state.xml file is sent.

If a connection is not open and Remote Services is enabled, a connection will be established by sending the connection string. Once the connection is established, state.xml will be sent.

Connection String

With Remote Services enabled, a connection attempt will be made periodically according to the Connection Interval setting in the **Advanced Network** setup tab. The Connection String is a user-defined character string configured in the **Advanced Network** tab.

The connection string is also sent at the same interval once the connection is open. The external server is responsible for closing the connection when it is done.

Appendix E: Log Files

X-320M™ logs information to two different log files: log.txt and syslog.txt. Both log files are text files and are stored in nonvolatile memory. This data will not be lost due to power failure and is also not cleared when restoring factory defaults. The log files are stored in circular buffers which write from the beginning of the allocated memory space to the end and then repeat from the beginning (over-writing the original data). The nonvolatile memory is divided into 4K byte sectors. Each time data gets erased to make room for new data, a full sector (4K bytes) is erased at one time.

Data Log File – log.txt

This log file is user-configurable under the **Logging** setup tab, and stores real-world data from the sensors connected to X-320M™(see section **2.4.6 Logging Tab** for more information). It can be up to 512K bytes long and is stored using a comma-separated value formatting scheme.

Measured values will only be displayed if they are selected in the **Logging** setup tab. The file is read by requesting the log.txt file from X-320M™. For example, using the default IP address, the following command would be used to request the log file:

```
http://192.168.1.2/log.txt
```

File Format:

```
Location: Logan, UT Site ID: 567584321
Elevation: 4457.000 Feet Lat, Long: 41.764N, -11.851W
Date Time, WSPD(mph), WDIR(deg), RAIN(in), TEMP(°F), HDTY(%RH), SRAD(W/m²),PRES(inHg),
AUX1(unit), AUX2(unit)
```

Date and Time Format:

MM – Month (01-12)

DD – Day (01-31)

YYYY – Year (1970 - 2106)

HH – Hour in 24 hour time (00 -23)

MM – Minutes (00-59)

SS – Seconds (00-59)

Sample File:

```
Location: Logan, UT Site ID: 567584321
Elevation: 4457.000 Feet Lat, Long: 41.764N, -11.851W
Date Time,WSPD(mph),WDIR(deg),RAIN(in),TEMP(°F),HDTY(%RH),SRAD(W/m²),PRES(inHg),AUX1(unit),AUX2(unit)
09/02/2011 02:05:00,15,270,20.00,78.57,34.00,400.00,29.97,0.00,0.00
09/02/2011 03:05:00,25,180,21.00,65.07,45.00,300.00,29.92,0.00,0.00
```

The file can then be saved using the 'Save As...' option under the 'File' menu of the web browser. If the TCP port has been changed (not port 80), the port will be required to read the file. For example, using the default IP address, and port 8000, the log file would be read as follows:

```
http://192.168.1.2:8000/log.txt
```

The log.txt file may be erased with the following command:

```
http://192.168.1.2/log.txt?erase=1
```

After erasing the file, it might be necessary to refresh the page.

Note: If the Control Password is enabled in the setup pages, the password will be required to access the log file.

System Log File – syslog.txt

The syslog file records various system events, which can be used for diagnostics and troubleshooting purposes.

File Format:

```
MM/DD/YYYY HH:MM:SS, (category to which message applies): (message)
```

Sample File:

```
01/02/2010 04:08:13 DEVICE: Power Up.
01/01/2010 00:41:05 DEVICE: Reset factory defaults.
```

Listed below is a description of messages that a user may see:

Category	Message	Description
DEVICE	Power Up	Device has been properly powered.
	Initialize	Device is ready.
	Reset Factory Defaults	Device has been reset to factory defaults.
EMAIL	Failed DNS Lookup	Unable to look up mail server due to an incorrect DNS setting.
	Bad Username	Email was not sent due to an incorrect user name.
	Bad Password	Email was not sent due to an incorrect password.
	Authentication Required	A user name and password are required by the mail server.
	No Response	No response from SMTP server.
CLOCK	RTC Reset	Real Time Clock has been reset.
NTP SERVER	Request Attempt	Device attempting to connect to NTP Server
	Failed DNS Lookup	Unable to lookup NTP server name due to an incorrect DNS setting.
	Success	Device successfully connected to NTP Server.
REMOTE SERVER	Failed DNS Lookup	Unable to look up Remote Server due to an incorrect DNS setting.
	Connection Attempt Started	Connection port with Remote Server has been opened.
	Connection Closed	Connection port with the Remote Server has been closed.
DHCP	Address Acquired	IP address request successful, and IP address assigned.
	Lease Renewal	IP address assigned to device was renewed.
MAIN_MCU	New Firmware Loaded	New firmware has been loaded to the device.

This file is read by requesting the syslog.txt file. For example, using the default IP address, the following command would be used:

```
http://192.168.1.2/syslog.txt
```

Note: The setup user name and password are required to access this file.

If the TCP port has been changed (not port 80), the port will be required to read the file. For example, using the default IP address and port 8000, the log file would be read as follows:

```
http://192.168.1.2:8000/syslog.txt
```

To erase the file, use:

```
http://192.168.1.2/syslog.txt?erase=1
```

Appendix F: Methods and Calculation Details

The following section describes the methods and calculations used for X-320M™ instrument measurements and derived values.

Sensor Acquisition Periods

Sensors connected to X-320M™ are sampled or updated every 2 seconds.

Analog values are captured every two seconds.

1-Wire sensors are read every two seconds.

Frequency and counter-inputs counts are accumulated during the two second period, and the measurements are derived from the accumulated value.

Solar measurements are only captured once per minute.

Actions associated with input state-changes are acted on when detected; they are not synchronous with the two second acquisition period.

Calculated values (Wind Chill, Dew Point, and Heat Index) are updated every 2 seconds.

Note: The measured and calculated values are not retained by X-320M™ during a power loss.

Compensation

Once the raw measurement is taken, the Slope and Offset are applied.

$$y = mx + b$$

y = Adjusted Value

m = Slope

x = Raw Value

b = Offset

After the Slope and Offset are applied, further calculations are applied that are dependent on the sensor. These calculations are described below for each sensor. Some values, such as heat index, are calculated based on measurements from a combination of sensors.

Measured Values

Wind Speed

The Wind Speed reading, by default, is a running average of 30 samples per minute over the Avg. Period specified in the **Wind Spd**. setup tab. The default Avg. Period is 2 minutes, which would use 60 samples to calculate the displayed wind speed. The maximum Average Period is 10 minutes. As new readings are made, the oldest values are replaced.

If the Averaging Period is set to 0, then the instantaneous wind speed is given, which is calculated from the instrument counts over a 2 second period.

Note: Wind Speed and Wind Direction use the same Averaging Period. Changing the Avg. Period in either setup page will affect the other setup page.

Wind Direction

The Wind Direction is a running average of 30 samples per minute over the Avg. Period specified in the **Wind Dir.** tab. The default ***Avg. Period*** is 2 minutes. The maximum Average Period is 10 minutes. As

new readings are made, the oldest values are replaced. If the averaging period is set to 0, then the instantaneous Wind Direction is given.

Note: Wind Speed and Wind Direction use the same Averaging Period. For example, if the Averaging Period is changed from 2 minutes to 4 minutes, both Wind Speed and Direction will be changed to 4 minutes.

Internally, the polar coordinates are converted to Cartesian coordinates and then stored. The running average is calculated using the Cartesian coordinates. These running averages are then converted back to polar coordinates and returned as the average Wind Direction. This method, along with some minor adjustments based on the quadrant measurement, is used to handle averaging the Wind Directions that vary around the 360 degree range. Otherwise, the average of 10 degrees and 350 degrees would be give an incorrect average of 180 degrees, instead of the correct average of 360 degrees.

Rain

X-320M™ keeps track of rainfall using the input to count bucket tips in a rain collector.

The 1 Hr Rainfall reflects the rainfall for the previous 60 minutes. This value is updated every 4 minutes.

The 24 Hr field indicates the amount of rainfall that has occurred in the previous 24-hours. This value is updated every 4 minutes.

The Previous 7 Days field shows rainfall that has accumulated over the last 7 days. It is updated daily at midnight.

Total Rainfall indicates how much rain has fallen since the counters were last reset. This value is updated with every bucket tip. The counters can be reset to 0 on the **Status Page.**

Note: Reset causes all Rainfall values to return to zero, including 1 Hr, 24 Hr, 7 Days, and Total.

Temperature

The Temperature reading is the instantaneous reading. No averaging is done. The current high/lows are initially set to the current temperature on power-up. The daily high and low temperatures are updated every 2 seconds.

At the beginning of a new day (0000:01 hrs), the “Today” high/lows are set to the “Yesterday” high/lows. The “Today” high/lows are set to the current Temperature reading.

Humidity

The Humidity reading is the instantaneous reading. No averaging is done. The current high/lows are initially set to the current humidity on power-up. The daily high and low humidity are updated every 2 seconds.

At the beginning of a new day (0000:01 hrs), the “Today” high/lows are set to the “Yeserday” high/lows. The “Today” high/lows are set to the current Humidity reading.

Solar Radiation

The Solar Radiation measurement is sampled once per minute. An Avg. Period setting of 1 min. will give an instantaneous reading. The maximum average period is 60 minutes. The new measurements replace the oldest reading.

Barometric Pressure

The Barometric Pressure reading is the instantaneous reading, no averaging is done. Once an hour, the current Barometric Pressure is stored. This provides an hourly history for the past 24-hours.

By default, the station will give an absolute pressure reading. This reading is affected by the altitude of the unit. By setting the Adjustment to Sea Level, the measurement is normalized to sea level with the following equation. The user will still need to enter Slope and Offset values for the particular sensor used.

$$Adjusted\ Pressure = p * \left(\frac{(288 - 0.0065 * h)}{288} \right)^{5.2561}$$

p = Barometric Pressure reading from the sensor in inches of Mercury

h = Station elevation in meters

Calculated Values

The following values are not measured from any particular sensor; instead they are calculated based on the information from several sensors.

Heat Index

Heat Index is based on Temperature and Humidity. The most recent instantaneous Temperature and Humidity values are used for this calculation.

Heat Index will only be calculated when the Temperature is greater than or equal to 80ºF and the Humidity is greater than or equal to 40% RH. Otherwise, the Heat Index will read the same as the current Temperature.

The following equation is used to calculate the Heat Index:

$$\begin{aligned} Heat\ Index = & -42.379 + (2.04901523 * t) + (10.14333127 * rh) \\ & - (0.22475541 * t * rh) - (0.00683783 * t^2) - (0.05481717 * rh^2) \\ & + (0.00122874 * t^2 * rh) + (0.00085282 * t * rh^2) - (0.00000199 * t^2 * rh^2) \end{aligned}$$

t = Temperature in Fahrenheit

rh = Relative Humidity

Wind Chill

Wind Chill is based on Temperature and Wind Speed. The calculation uses the most recent temperature measurement and the average Wind Speed, as shown on the **Status page**.

Wind Chill will only be calculated when the Temperature is below or equal to 50ºF and the Wind Speed is greater than or equal to 3 mph. Otherwise, Wind Chill will read the same as the current temperature

The following equation is used to calculate the Wind Chill:

$$Wind\ Chill = 35.74 + (0.6215 * t) - (35.75 * w^{0.16}) + (0.4275 * t * w^{0.15})$$

t = Temperature in Fahrenheit

w = Wind Speed in mph

Dew Point

Dew Point is based on Temperature and Humidity. The most recent Temperature and Humidity values are used for this calculation.

Dew Point will only be calculated when the Temperature is between 0ºC - 60ºC, and the Humidity is greater than or equal to 1%RH. Otherwise, Dew Point will display "--".

Note: If the calculated Dew Point is greater than 50ºC it will not be displayed.

The following equation is used to calculate the Dew Point:

$$Dew\ Point = \frac{b * \alpha(T, RH)}{a - \alpha(T, RH)}$$

$$\alpha(T, RH) = \frac{a * T}{b + T} + \ln(RH)$$

a = 17.27

b = 237.7 ºC

T = Temperature in Celsius

RH = Relative Humidity

Wind Gust

A Wind Gust is a sudden, brief increase in Wind Speed, typically lasting less than 20 seconds with speed greater than 10 knots above lulls.

X-320M™ measures the Wind Speed over a two second period. This is considered a sample value used in the running average. A gust is detected when the wind velocity exceeds 10 knots (11.5 mph, 18.54 kph) above the lowest Wind Speed sample within the Averaging Period. By default, the Averaging Period is 2 minutes. The gust must last less than 20 seconds. Longer duration sustained winds are not considered gusts.

A Wind Gust lasting 19 seconds may have several speed values throughout the duration. These are displayed in the order that they occur. The first value will not be displayed until 20 seconds after it was captured.

Note: If no Averaging Period is used (Avg. Period = 0), Wind Gusts will not be reported.

Appendix G: Common Sensor Setup Parameters

The following are setup parameters that may be used with typical weather sensors. Please refer to the **2.2 Connection** for descriptions on the respective electrical connections.

X-320M ™ is easily adapted to the Davis Integrated Sensor Suite (ISS) by using the Davis adapter board, Xytronix product number X-MDA-1. Please refer to X-MDA-1 product information on the ControlByWeb web site.

Wind Speed

X-320M™ can utilize the frequency input or either of the digital inputs for wind speed. Wind speed sensors predominately use one of two methods, frequency generator or reed switch closure.

Make	Model	Output	Slope	Offset	Settings	Connections
Davis	6410	N.O. Reed Switch	mph: 2.25 km/h: 3.62	0	I/O: Input, Pull-Up, Increment when input off	Digital Input Ground
Met One	034B	N.O. Reed Switch	mph: 1.7873 m/s: 0.7989	mph: 0.63 m/s: 0.28	I/O: Input, Pull-Up, Increment when input off	Digital Input Ground
RM Young	5103	Frequency	mph: 0.2192 m/s: 0.0980 km/h: 0.3528 knots: 0.1904	0	--	Frequency Ground

Additional compatible sensors are available from Met One, RM Young, NRG, and others.

Wind Direction

X-320M™ is compatible with potentiometer-type wind sensors. These sensors utilize the analog input.

Make	Model	Output	Slope	Offset	Settings	Connections
Davis	6410	0-5 VDC	72	0	--	+5 Vref Ground Analog Input
Met One	034B	0-5 VDC	72	0	--	+5 Vref Ground Analog Input
RM Young	5103	0-5 VDC	72	0	--	+5 Vref Ground Analog Input

Additional compatible sensors are available from Met One, RM Young, NRG, and others.

Rain

Tipping bucket rain gauges are common precipitation sensors. These can be connected to the digital input of X-320M™ to count the bucket tips. Capacitive gauges may also be used through the analog inputs of X-320M™.

Make	Model	Output	Slope	Offset	Settings	Connections
Davis	7852	N.O. Reed Switch	in: 0.01 mm: 0.254	0	I/O: Input, Pull-Up, Increment when input off	Digital Input Ground
RM Young	52203	N.O. Reed Switch	in: 0.00394 mm: 0.1	0	I/O: Input, Pull-Up, Increment when input off	Digital Input Ground
Water Log	H-340	N.O. Reed Switch	in: 0.01 mm: 0.254	0	I/O: Input, Pull-Up, Increment when input off	Digital Input Ground
Met One	360	N.O. Reed Switch	in: 0.01 mm: 0.254	0	I/O: Input, Pull-Up, Increment when input off	Digital Input Ground
Met One	364	N.O. Reed Switch	in: 0.00394 mm: 0.1	0	I/O: Input, Pull-Up, Increment when input off	Digital Input Ground

Temperature

X-320M™ can be used with 1-Wire temperature sensors such as Xytronix X-DTS-U, X-DTS-WM, and X-DTS-S12. Linear response analog sensors (voltage or current output) may also be used. Non-linear thermistors are not compatible.

The use of 1-Wire sensors has the advantage of allowing multiple sensors to be installed and frees up analog ports for other sensor options.

Make	Model	Output	Slope	Offset	Settings	Connections
Xytronix	X-DTS-U X-DTS-WM X-DTHS-S12 X-DTS-S12	1-Wire	F: 1.0 C: 0.5555	F: 0 C: 17.778	--	5Vout Gnd Data
RM Young	41382VC	0-5 VDC	C: 20	C: -50	--	5Vref Agnd Ain
RM Young	41382VF	0-5 VDC	F: 40	F: -50	--	5Vref Agnd Ain

Radiation shields such as the Davis Instruments 7714 or RM Young 41003 may be required.

The RM Young sensors are often listed as 0-1 VDC output. These sensors have a selectable output range and can be configured as 0-5 VDC. Please refer to the sensor instruction sheet.

Humidity

X-320M™ can be used with 1-Wire humidity/temperature sensor such as Xytronix X-DTHS-WM. Linear response analog sensors (voltage or current output) may also be used. Non-linear thermistors are not compatible.

The use of 1-Wire sensors has the advantage of allowing multiple sensors to be installed and frees up analog ports for other sensor options.

Make	Model	Output	Slope	Offset	Connections
Xytronix	X-DTHS-S12	1-Wire	F: 1.0 C: 0.5555	F: 0 C: 17.778	5Vout Gnd Data
RM Young	41382VC	0-5 VDC	%RH: 20	0	5Vref Agnd Ain
RM Young	41382VF	0-5 VDC	%RH: 20	0	5Vref Agnd Ain

Radiation shields such as the Davis Instruments 7714 or RM Young 41003 may be required.

The RM Young sensors are often listed as 0-1 VDC output. These sensors have a selectable output range and can be configured as 0-5 VDC. Please refer to the sensor instruction sheet.

Solar Radiation

Solar radiation sensors can be installed on the analog input ports.

Make	Model	Output	Slope	Offset	Connections
Apogee Instruments	SP-215	0-5 VDC	W/m^2: 250	0	5Vout Gnd Data
Met One	096	0-5 VDC	W/m^2: 125000	0	5Vref Agnd Ain

Barometric Pressure

Barometric Pressure sensors are typically installed on the analog input ports.

Make	Model	Output	Slope	Offset	Connections
Apogee Instruments	SB-110	0-5 VDC	hPa: 218 mmHg: 6.437	hPa: 114 approx mmHg: 6.437 approx.	5Vout Gnd Data
Met One	092	0-5 VDC	hPa: 100	hPa: approx.	5Vref Agnd Ain

Soil Moisture

Soil Moisture sensors are typically installed on the analog input ports.

Make	Model	Output	Slope	Offset	Connections
Irrometer	200SS-V	0-2.8 VDC	cb: 85.36	0	5Vref Agnd Ain

Digital Input / Lightning

Digital inputs may be used for any input state signal. This may be used for input signals from such devices as a lightning detector, water sensor, door switch, or motion detector.

Appendix H: Specifications

Power Requirements

- Input Voltage: 9-28 VDC
- Current: See table below for typical values at 25°C.

***10 Mbps* Network Speed**

Power Supply	Digital Outputs		Digital Inputs w/ Pull Resistors	
	All Off	All On	Pull-up	Pull-down
9 VDC	160 mA	182 mA	179 mA	160 mA
12 VDC	121 mA	136 mA	136 mA	121 mA
24 VDC	66 mA	74 mA	73 mA	66 mA

***100 Mbps* Network Speed**

Power Supply	Digital Outputs		Digital Inputs w/ Pull Resistors	
	All Off	All On	Pull-up	Pull-down
9 VDC	269 mA	288 mA	290 mA	269 mA
12 VDC	203 mA	219 mA	219 mA	202 mA
24 VDC	107 mA	114 mA	115 mA	107 mA

I/O Connector

- 14-position, removable terminal strip, 3.81 mm spacing
  (Replacement part number, Phoenix Contact 1803691)

Digital Inputs/Outputs

- Programmable I/O (2)
- Transient over-voltage protection

Input Mode

- Discrete Inputs (connect to dry contacts)
- Configurable debounce, 0 to 65535 ms
- Pulse Counter, 32-bit (250 Hz-max)
- 5 Vmax Input
- 47 kohm Programmable 5 V pull-up/pull-down resistor
- Schmitt trigger input (> 0.7 V hysteresis)
- 2.7 $V_{low\text{-}high}$ (typical)
- 1.8 $V_{high\text{-}low}$ (typical)

Output Mode

- Logic output to external controllers
- 5 V_{high} through 49.9 Ohm resistor

Pulse Counters

- See Digital Input Mode
- 2 second average
- 0.5 Hz read rate

Frequency Input

- 0-130 kHz input frequency
- AC or DC input, 20 V peak to peak
- Sine or square wave (Triangle wave, add 10% to Min Vin)
- 2 second average
- 0.5 Hz read rate
- Auto-zero, positive slope detection
- Accuracy and minimum input level:

Input Frequency	Min Vin	Read Error
0 to 1 Hz	65 mV	+/- 0 Hz
1 Hz to 3.5 kHz	60 mV	+/- 0.0 Hz
3.5 kHz to 120 kHz	60 mV	+/- 0.5 Hz
120 kHz to 130 kHz	60 mV	+/-3 Hz

Analog Inputs

- 4 Single-ended Channels
- ±0.02% + 30 uV Full Scale SE mode (25°C)
- 10 µV resolution
- 0 to 5 V input, full scale
- 151 ms sequential channel read time

Temperature/Humidity Sensors

- 6 Sensor maximum
- 600 ft (180 m) maximum combined cable length

Temperature Sensors

- “1-Wire” Digital Thermometer (Dallas Semiconductor DS18B20)
- +/-0.5°C from -10°C to +85°C

Humidity Sensors

- “1-Wire” Digital Sensor
- 0-100% RH +/- 1.8%

Network

- 10 Base-T or 100 Base-T Ethernet IPv4
- Static IP address assignment or DHCP
- HTTP port selectable
- Standard 8-pin RJ-45 Modular Socket
- Supports Web Browser (HTTP), XML, Modbus/TCP, SNMP protocols

5 LED Indicators

- Power On
- I/O (1-2)
- Network Linked
- Network Activity

Real-Time Clock

- Manual or NTP (Network Time Protocol) setup
- NTP Sync Configurable for Once, Daily, Weekly, or On Power-up
- Automatic Daylight Savings Adjustment
- Battery (capacitor) Power Backup

Capacitor Power Backup

- Supports Real-Time Clock, External Variables, Output State
- 3 days Minimum Duration

Nonvolatile Memory

- Flash Memory
- All user settings are stored in nonvolatile memory. Settings will not be lost when power is disconnected.

Environmental

- Operating Temperature: -30ºC to 70ºC (-22ºF to 158ºF)
- Storage Temperature: -40ºC to 85ºC (-40ºF to 185ºF)

Mechanical

- Size: 1.41 x 3.88 x 3.1 in. (35.7 x 98.5 x 78 mm), connector not included
- Weight: 4.8 oz (136 g)

Logging

- Stored in Nonvolatile Flash
- Circular Buffer
- 512 kB (Up to 42000 log entries)
- Unlimited data storage possible through web services.

Password Settings

- Password protection on **Setup Page**
- Optional Password protection on **Status Page**
- Base 64 Password Encoding
- 13 Character, Case-Sensitive Password Length

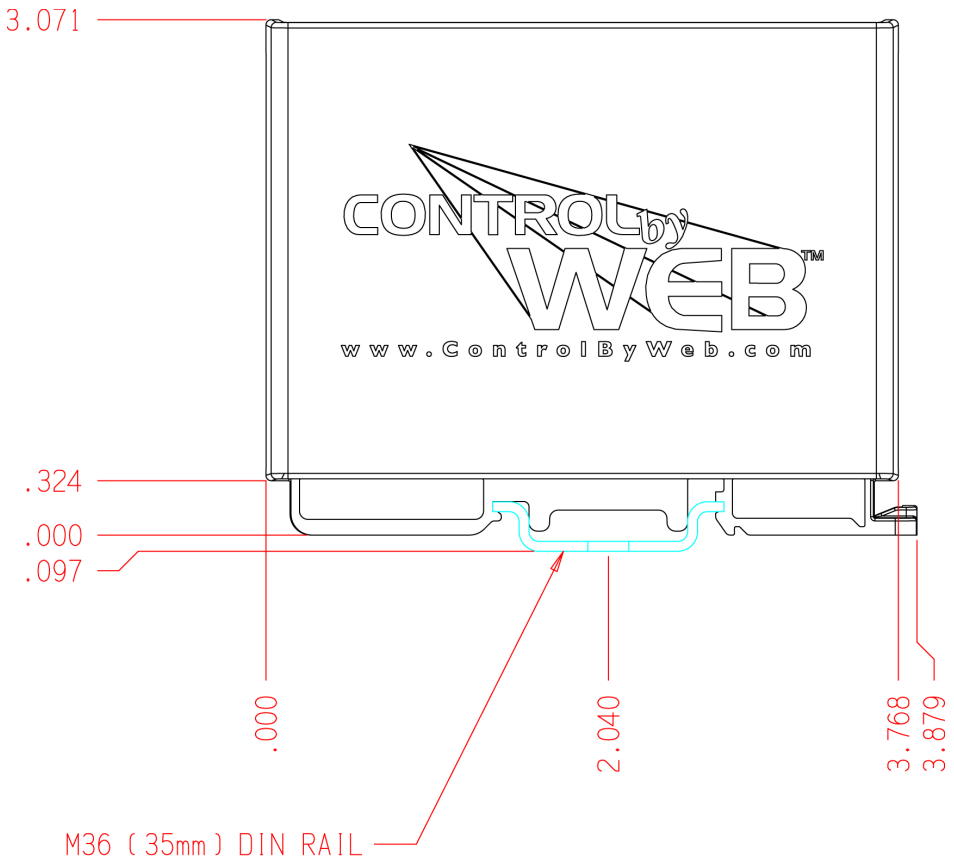
Electromagnetic Compliance

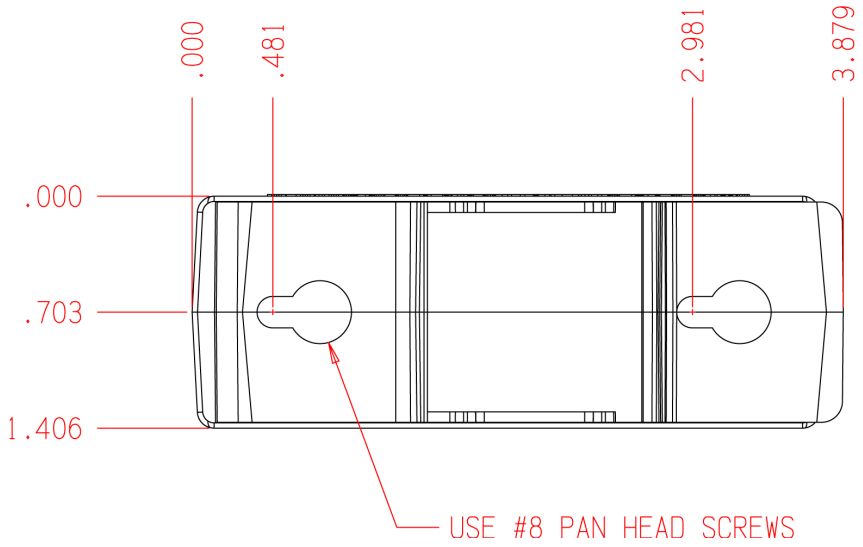
- IEC CISPR 22, CISPR 24
- FCC 47CFR15 (Class B)
- EU EN55024, EN55022

Product Safety Compliance

- IEC 60950-1 / EN 60950-1

Appendix I: Mechanical Information





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